SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

*THE GENERAL CONFERENCE OF THE INTERNATIONAL GEODETIC ASSOCIATION AT STUTTGART, OCTOBER 3–12, 1898.**

THE International Geodetic Association is an organization for the measurement of the earth. Conferences are held every few years to consider projects, formulate methods and direct the execution of work by which the aforesaid object may be attained. Although the name as used in English does not necessarily imply the determination of the earth's size and shape, this is, nevertheless, the governing idea, and the Association follows loyally the lines marked out by the society of which it is the legitimate offspring, the German Gradmessung of 60 years ago. Now that the Association is firmly established on a permanent and international basis, it is worth while to seek the origin and trace its interesting course of development. In 1829 the Russian government expressed a desire to connect their triangulation with that of Prussia. Thus stimulated, the German work was given greater expansion, and in 1838 the work of Bessel and Baeyer, 'Gradmessung in Ostpreussen,' appeared. This developed into the 'Kustenvermessung,' and the work was continued under that name. In 1861 Baeyer sounded the keynote of the scientific spirit of the age when he proposed co-

* Published by permission of the Superintendent of the Coast and Geodetic Survey.

operation with other nations and laid the foundation for what was called the middle European 'Gradmessung.' These limits held until 1867 when the word 'middle' was dropped and the Association was enlarged to comprise representatives from all Europe. The extension seemed for a time to satisfy the energy everywhere manifest, but the fact soon became apparent that the work fell short of its full usefulness in that its bounds of activity were still too restricted. Perhaps the gigantic strides made by America and Australia in mental and material development had something to do with the change. At any rate, in 1886, the name was again changed; this time from the European 'Gradmessung' to the international 'Erdmessung.' A convention was drawn up for ten years. The powers of the League were considerably enlarged, old fetters were broken, and for the first time the Association reached its highest plane of usefulness and began to direct a homogeneous plan for the measurement of the earth.

The twelfth general conference was held at Stuttgart from the 3d to the 12th of October, 1898. Fifteen countries of the nineteen composing the Association were represented. Of the thirty-seven delegates present, fifteen came from Germany, five from France, three from Italy, two from Switzerland, two from Japan, and one each from Belgium, England, The Netherlands, Austria-Hungary, Russia, Sweden, Spain, Mexico and the United States. Each government has the privilege of sending as many delegates as it pleases, but in voting on questions coming before the conference for action but one ballot is allowed to each country. Besides the delegates, eighteen invited guests appeared, making a total of fifty-five persons present at the meetings. By far the greater part of the time was naturally taken up in reading the regular reports by the delegates on the geodetic work accomplished in their respective countries since the last general conference. Of special interest was the contribution by Professor Helmert on the activity of the Central Bureau of the Association at Potsdam. The following work was described:

I. The systematic deviations of the plumb line in connection with the European arc on the 52° of north latitude.

II. The international latitude service.

III. Absolute determinations of gravity.

Without going into details at this stage of our narrative, we may note in passing one or two points brought out. The connection between Switzerland and Italy is now satisfactorily made. It rests, however, on a single triangle, due to the fact that one of the points composing the quadrilateral proposed was not occupied identically by the two surveys.

The international latitude service will be inaugurated during the summer of 1899 at four stations under the direct control and at the expense of the Association. Observations at two additional stations will be undertaken, for which the Central Bureau will supply only a part of the funds necessary. Although the mathematical conditions are not essentially changed by the introduction of Cincinnati and Tschardjui, there is great advantage from the fact that any systematic errors in the regular stations will be more readily discovered. It is a fortunate coincidence that the observatory at Cincinnati happens to be precisely on the parallel of latitude chosen for this work, and it is, moreover, a matter for congratulation that Russia is ready and willing to aid in the undertaking, to the extent of establishing and superintending the station at Tschardjui.

The report also stated that in the absolute gravity work measurement of the length of the pendulum, the most difficult operation in the whole problem, can be effected both in a horizontal and vertical position.

The knife-edges can be illuminated in any direction by means of movable mirrors, and the field of view is kept at the same time uniformly lighted. Experiments with an electric magnet have shown that the earth's magnetic force only exercises a retarding influence on the swinging, without having any effect on the resulting length of the mathematical seconds pendulum. The possible slight movement of the agate plate, as well as the slip of the knives, is observed by a specially designed apparatus.

It is worthy of mention in this connection that up to the present time nearly 1,400 gravity stations have been occupied, of which 1,228 are different. Austria heads the list with 698, Germany follows with 162, and the United States comes next with 88. The greater part of the remainder falls to Denmark, Russia, Switzerland, France and Italy. About fifteen different nationalities are represented in this work. The latest results from pendulum observations are with reference to changes of the force of gravity with elevation, and the derivation of a new formula for the length of the seconds pendulum at the sea-level. From a discussion of over 500 stations the conclusion is reached that what is usually known as continental attraction amounts practically to nothing, and that in general the change of the force of gravity at any point on the earth's surface depends purely and simply on the Newtonian law of the inverse square of the distance. The introduction of a spherical function of the third order in the formula for L, alluded to above, foreshadows the determination of a different curvature for the northern and southern hemispheres of the earth; yet tne coefficient appears so small that the inequality cannot as yet be safely predicted. The compression given is 1/297 and the equatorial value of the force of gravity is about 1/13,000 greater than that now accepted. The investigation of the relation between disturbances in the force of gravity and deviations of the plumb line is one of the most interesting problems of the near future.

The reports read by the different delegates need not be taken up here. Although full of interest to the geodesist and astronomer, they are too voluminous to be analyzed or discussed in the short space at our disposal. They will, however, be published in full, and will appear in the Proceedings of the conference, where they may be consulted and studied.

Three matters of universal interest were brought before the Association, and suitable action was had thereon. These were: I. 'The determination of the figure of the earth by the measurement of arcs and the determination of the force of gravity.' II. 'The remeasurement of the Peruvian arc.' III. 'The redetermination of the difference of longitude between Paris and Greenwich.' The first two subjects were introduced as resolutions by the United States delegate, and brought out interesting discussions. The first was proposed for the sake of directing the attention of the Association more specifically to the prime object of its existence. No one doubts the utility or necessity of a complete study of the law governing the changes of latitude, but its ultimate bearing is rather one of astronomy than geodesy. The funds of the Association are now being devoted largely to the latitude question, and the time seemed fitting to suggest work more directly in the line of its avowed purpose—the measurement of the earth. The object of the resolution was, therefore, in the nature of a recall to the original conception of its being, and bespoke in the interest of pure geodesy an application of its resources to a realization of the idea of its founders.

The remeasurement of the Peruvian arc now appears to be assured. It may be worth while just here to recall the essential features of this work. One hundred and

sixty years ago, when it was a disputed question whether the polar or equatorial diameter of the earth was the longer, the French Academy decided to make one supreme effort to settle the point. To this end, two arcs were measured: one on the equator (now known as the Peruvian arc, although it is really in Ecuador); and the other in Lapland, as near the pole as possible. These two arcs, confessedly inaccurate in the light of modern geodesy, have been employed continually in the determination of the earth's figure. Situated as they are, near the extremities of the quadrant, their influence is great on the shape deduced, so that one of the pressing needs of the day in the measurement of the earth is a redetermination of their lengths. France having made the first measure, by common consent, this country should be given the first chance to repeat the equatorial work. At the conference in Paris in 1889 the matter was brought up, but was left to be disposed of by France. Efforts were made to accomplish the task, the officers were in part designated, and arrangements for cooperation by the government of Ecuador were completed. At this juncture the revolution broke out in Ecuador and the matter came to an untimely end. It is now proposed to make a reconnaissance during the summer of 1899, report the results thereof to the Paris conference of 1900, and then decide definitely on the plans of final measurement. It is universally conceded that France should be given the first chance to act, not alone because the first measure was made by her, but also because the conference of 1889 relinquished in her interest further consideration of the subject.

The Russians and Swedes, in a quiet sort of way, are measuring an arc between the parallels of latitude $77\frac{1}{2}°$ and $81\frac{1}{2}°$ in Spitzbergen. The triangulation will require two summers and part of one winter, and will cost 100,000 Kronen ($27,500), exclusive of cost of vessels furnished by the governments. The field work will be finished in 1900 and the computations two years later. Fifty stations will be occupied. The sides range in length from ten to one hundred and thirty kilometers, and the bases, of which there will be only two, are to be measured with with Jaederin's steel tape line, 20 meters long.

The difference of longitude between Paris and Greenwich comes up again for investigation. This question has been a sort of thorn in the side of European geodesy for ten years. In 1872 the United States Coast Survey made a determination, in order to have a check on the telegraphic longitude of our trigonometric points as determined independently from Paris and Greenwich. This was followed in 1888 by two separate determinations, one on the part of England, the other on the part of France. The results differed by more than two-tenths of a second. Our own result falls between them, and it is a matter of congratulation to all Americans that the best determination to the present day of this important quantity is the work done by the United States Coast Survey, while incidentally checking its own longitude determinations. Nothing was done to improve the agreement until 1892, when the work was repeated, both by the French and English, only to yield results practically identical with those previously obtained, so the unfortunate discrepancy still remains, and the five direct determinations already made leave the work in an unsatisfactory condition. Six indirect results may be had from combinations of general European work, through Brest, Vienna, Berlin, Bonn and Leiden, the mean of which gives the same result as the mean of the direct determinations. Nothing seems to remain, therefore, but to study the conditions of the work of 1888 and 1892, and reconcile, if possible, the outstanding difference. The

matter has been referred by the International Geodetic Association to the directors of the two observatories, and a definite result will, doubtless, soon be made known.

The variation of the latitude seems to be at present an absorbing question before the Association, and there results from action taken at the Stuttgart meeting the following status:

Six stations will be established during the summer of 1899 on the parallel of latitude. 39° 8′. These will be distributed in longitude as follows: one each in Japan, Turkestan and Italy, and three in the United States. The American ones will be located at Gaithersburg, Md.; Cincinnati, O., and Ukiah, Cal. This gives a preponderance of weight to the determination of the coordinate Y (X passing through Greenwich), but a station in Portugal, which may possibly be secured later, would essentially increase the accuracy of X. Tschardjui, in Russia, and Ukiah, in California, are nearly opposite, and Mizusawa, in Japan, is in the only remaining unoccupied quadrant. The scheme proposed is, therefore, a favorable one for the study of the motion of the pole. No one knows as yet how long it will be desirable to continue the observations. The period now provided for is five years, but it is proposed to buy the land upon which the observatories will be located, or lease it for one hundred years. It is evident that at least twenty-one years would be desirable, because during the seven years of observations already made the pole has returned nearly to its mean position, and three of these cycles should be completed before any definite idea can be had as to its mean path. The cost of the entire work will be about $10,000 annually. The visual method is to be followed regularly without, however, excluding the possibility of employing later the photographic one, which has already given excellent results. Twelve groups of stars, each comprising eight pairs, will be selected. Six pairs in each group are destined for the latitude determinations proper, while the two remaining pairs, having great zenith distances (about 60°), will, it is hoped, throw light on the question of refraction. The observing period for each night is four hours, and will vary from 7 p. m. to 3 a. m., depending on the situation of the group. The instrumental outfit will consist of a zenith telescope and astronomical clock for each station, except that of Japan. Here a chronometer will be substituted for the clock, on account of the frequency of earthquakes.

Although the object of the general conference was scientific discussion, a faithful historian cannot ignore the social and humanitarian side of the function. From our entrance into the beautiful capital of Wurttemberg until the time of our departure we were the recipients of the most cordial hospitality. The first session was devoted to addresses of welcome on the part of the government officials, and replies thereto by the officers of the Association. Cards of admission to the museums and public buildings were furnished, excursions to the fine old castles of the suburbs were given (always including a sumptuous lunch during the day at the expense of the government), and a final gala banquet marked the close of the convention. The official means of communication before the conference was either French or German. English, Spanish and Italian were sometimes heard during recess, but not during debate. The Japanese, Russians and Swedes spoke German; the Italians and Spanish, French; the Swiss, both. One delegate, in a moment of absent-mindedness, voted in his native tongue. The novelty of the proceeding seemed attractive, and forthwith each representative did likewise. This gave increased momentary interest to the balloting, which culminated in great hilarity when, the President, a distinguished Frenchman,

who had never been known to use anything but his native tongue at the meetings, responded 'Ja.'

Before closing the present paper, attention should be called to a few points of interest noted during the trip to Stuttgart and return. A flying visit was made to the Royal Observatory at Berlin, the Reichsanstalt at Charlottenburg, and the Geodetic Institute at Potsdam. At Paris the offices of the geographic service and the International Bureau of Weights and Measures were examined, and part of one day was devoted to the English Ordnance Survey at Southampton.

An interesting object at the Berlin observatory is the instrument with which Küstner discovered the variation of latitude. Not alone because of the splendid result achieved, but on account of the conditions under which the work was done. It is mounted on a pier more than twenty feet above ground, on a subsoil of sand, in the middle of a city, with bad atmospheric conditions and about one hundred feet from the public thoroughfares. In spite of these adverse circumstances a new fact was added to science, which had baffled the efforts of larger telescopes under immeasurably better conditions. There is much encouragement in this to investigators with scanty means at their disposal.

At the Aichungs-Kommission a balance was shown which easily determines the weight of a kilogram with an error of 1/200 of a milligram, being 1/200,000,000 part of the quantity sought. They have also a complete series of weights in quartz from 1/2 gram to one kilogram, and thermometers giving the temperature by estimation to 1/1000 of a degree Centigrade.

At Charlottenburg the most striking feature was the extension and perfection of the organization. Nine buildings in all, of which the two larger are devoted, one to theory and the other to practice, have cost, together with the running expenses since 1887, 3,000,000 Marks. The annual outlay is at present about $90,000.

The Geodetic Institute at Potsdam has been much less expensive, and presents many admirable points of arrangement and administration. Among the details may be cited: the clock room, always maintained at a temperature between 20° and 21° Centigrade; the pendulum room, artifically heated on all sides, including the floor; a pillar over fifty feet high, and correspondingly thick, with meridian marks several miles away, to study changes in azimuth and the movement of the earth's crust; and finally a small photographic instrument, by means of which the occupation of a station only requires 8 minutes, and gives a determination of the geographical position in latitude within two seconds of arc. The subsoil, as at Berlin, is nothing but sand.

At Sevres, near Paris, several interesting instruments were seen, among which may be especially mentioned that designed for the comparison of the metre with the wavelength of light following Michelson's method, and the apparatus for the determination of coefficients of expansion according to the method of Fizeau. Some recent experiments have been made on a composition containing 36% nickel and 64% steel. It appears that the expansion from heat is thus reduced to about 1/50 of what we should expect from the individual components. This discovery will simplify enormously the solution of problems where the temperature question has thus far been the great difficulty. It will, for example, be a comparatively easy matter to make pendulum clocks run with a daily correction of about 1/10 of a second per day under varying temperature conditions.

At the office of the geographic service of the army a noteworthy feature was the publication of charts. Six presses, each

capable of turning out six hundred maps per hour, are continually at work. Each year there are printed and distributed 1,200,000 maps, about as many as the Coast and Geodetic Survey has published since it came into existence. At Southampton, where the office of the English Ordnance Survey is located, the personnel consists of about nine hundred persons, of which probably one hundred belong to the army. The map printing establishment has even greater capacity than that at Paris, 3,000,000 maps being delivered annually. Although the great trigonometric work may be considered as finished in England, nevertheless, the topographic work goes on, and the effort is made to cover the whole kingdom once in twenty years with a new map on a scale of 1/2.500, and once in fifteen years with one on 1/10,000. Of course, the latter is made from the former by making blue prints, tracing in black the detail required, and photographing again, which leaves out everything in blue on the original sheet.

E. D. PRESTON,
Delegate on the part of the United States.
U. S. COAST AND GEODETIC SURVEY.

THE ANNUAL REPORT OF THE SECRETARY OF AGRICULTURE.

THE Report of the Secretary of Agriculture for 1898, just issued, is of interest as showing the growth of the technical and scientific work of the Department. This national agency for the promotion of agriculture now consists of two bureaus, two offices and fourteen divisions, most of which are engaged in scientific inquiries. A few of the more salient features of the work of the Department during the last year may serve to indicate the lines in which it is making progress.

The Weather Bureau has greatly increased the efficiency of its forecast service by the establishment of a considerable number of observation stations in the West Indies and additional stations in the more arid regions of the West. A climate and crop service has also been begun in Alaska.

The Bureau of Animal Industry has had great success in its experiments for the repression of hog cholera by the use of specially prepared serum. The experiments in dipping cattle to kill the ticks which cause Texas fever have also been successfully conducted on a large scale.

The work of the Division of Chemistry on the composition and adulteration of foods and on sugar beets has been quite extensive. Studies of typical soils in the vegetation house by the Division have shown that "Meteoric influences other than those relating to precipitation have a great influence on crop production. The solar influences are evidently of great importance, and the distribution of solar heat is a factor not to be neglected."

Among the more important investigations of the Division of Entomology have been those on the Morelos orange fruit worm, the Mexican cotton-boll weevil, chinch bug, Hessian fly and San José scale.

The Biological Survey is energetically pushing its researches on the life zones of the United States.

The Division of Vegetable Physiology and Pathology has made interesting investigations relative to increasing the sugar and starch producing power of plants and the effect of soil foods on their growth and productiveness. A large amount of hybridizing has also been done with oranges and other citrus fruits, pineapples, pears, wheat and other crops.

Our knowledge of the native forage plants of the Great West has been considerably enlarged by the recent work of the Division of Agrostology, which has added nearly 3,000 sheets of specimens to the National Herbarium during the year.

The Division of Soils has perfected and cheapened its electrical apparatus for the

determination of soil moisture and has begun the detailed mapping of soil areas adapted to different crops.

The Division of Forestry has been reorganized under its new Chief and will devote itself more largely to experiments on a relatively large scale in the economic management of forest lands and the reforesting of the Western plains.

Besides its work on the National Herbarium, the Division of Botany is enlarging its studies of seeds and has recently been charged with the supervision of seed and plant introduction from foreign countries, for which the Department already has several agents at work in different countries.

The method of crop reporting has been improved under the direction of the present Chief of the Division of Statistics, and special economic investigations, such as those relating to the cost of producing a bale of cotton and the world's consumption of wheat, have been undertaken.

The Section of Foreign Markets has issued timely and valuable reports on the commerce of Hawaii, Spain and Puerto Rico.

The Office of Experiment Stations, besides general supervision of the expenditures of the 53 experiment stations, preparation of the Experiment Station Record and other publications based on the work of the stations, has had the direction of special investigations on the agricultural capabilities of Alaska and on the food and nutrition of man. Recently this office has also been charged with investigations on irrigation, which are to be carried on in cooperation with the experiment stations and State engineers in the irrigated region. In connection with the nutrition investigations, the Atwater-Rosa respiration calorimeter has been so far perfected that "not only the nutritive value of the food consumed, but also its relation to the heat and energy evolved by the human body during periods of rest and work have been measured with a completeness and accuracy hitherto unknown."

The examination of the work and expenditures of the agricultural experiment stations by the Office of Experiment Stations during the past year has shown that these institutions are, as a rule, working more thoroughly and efficiently than ever before for the benefit of American agriculture. More than six hundred persons are employed in the work of administration and inquiry. About four hundred reports and bulletins were issued by the stations in 1897, which were directly distributed to over half a million addresses, besides being widely reproduced in the agricultural and county papers. The appropriation of $720,000 from the National Treasury for the support of the stations was supplemented by State funds aggregating over $400,000.

"The need and value of scientific researches on behalf of agriculture are now very clearly understood, and the number and importance of institutions organized for this work are constantly increasing in all parts of the world. Nowhere has so comprehensive and efficient a system of experiment stations been established as in the United States. In the scope and amount of their operations, and in the thoroughness with which the useful information they obtain is disseminated among the farmers, our stations are unsurpassed. During the ten years which have elapsed since the Hatch Act went into effect a very large amount of accurate information of direct practical benefit to our farmers has been published by the stations. Not only have the numerous bulletins and reports of the stations been freely distributed in all parts of the country, but many valuable books largely based on the work of the stations have been written for the farmer's use, while the agricultural press has busily collated and disseminated a vast amount of information directly relating to the work

of the stations or supplementary to it. The contrast between the correct information regarding the principles and practices of his art easily obtainable by the farmer of to-day and that available for his predecessor a generation ago is very wide and striking."

The Secretary strongly urges that the stations should more fully devote themselves to original investigation in behalf of agriculture.

"Political considerations should have no place in the choice and retention of station officers; college duties should not be allowed to encroach upon the time set apart for original investigation, and the compilation of old information should always be made secondary in the acquirement of new knowledge.

"The stations are not the only means for the education of the farmer. Agricultural colleges, farmers' institutes, boards of agriculture and various other agencies have been established to instruct the farmer regarding the present status of agricultural science as applied to his art. It is the business of the experiment stations, on the other hand, to advance knowledge of the facts and principles underlying successful agriculture and to teach the farmer new truths made known by their investigations. The Act of Congress creating the stations clearly defines their functions to be the making and publishing of original investigations. Wherever a station has neglected this and merely endeavored to educate the farmer we find a weak station, and wherever a station has earnestly devoted itself to original investigations we find a strong station."

The Secretary also heartily commends the movement to secure the introduction of nature-teaching into the common schools, and favors the providing of special privileges for graduate students in the scientific divisions of the Department.

In general, the tone of the Secretary's Report is very encouraging to the scientific workers of the Department, for, while he strongly insists on the necessity of bending every energy to the securing of results of wide practical application, it is clear that he believes that this end can be most certainly and effectively reached by broadening and strengthening the scientific researches of the Department.

The following schedule indicates in brief the present development of the Department as an agency for research and education in agricultural science.

THE DEPARTMENT AS AN AGENCY FOR RESEARCH AND EDUCATION IN AGRICULTURAL SCIENCE.

Weather Bureau: Researches in climatology and meteorology.

Bureau of Animal Industry: Researches on animal diseases, including chemical, bacteriological and zoological investigations.

Division of Statistics: Collection and study of agricultural statistics.

Division of Entomology: Researches on life history and geographic distribution of insects and on means of repression of injurious insects.

Division of Chemistry: Researches on soils, fertilizers, foods, sugar-producing plants, methods of analysis, etc.

Division of Botany: Researches on the natural history, geographic distribution and utilization of plants, special studies on seeds and on poisonous and medicinal properties of plants, and collection of seeds and plants from foreign countries.

Division of Forestry: Researches on the natural history, biology and utilization of forests and forest trees and on timber physics.

Division of Biological Survey: Researches on the geographic distribution of plants and animals and on food habits of birds and mammals.

Division of Pomology: Studies on varieties of fruits and nuts.

Division of Vegetable Physiology and Pathology: Researches on the physiology and diseases of plants.

Division of Soils: Researches in agricultural physics, especially on the physical properties, moisture, temperature, etc., of soils.

Division of Agrostology: Researches on natural history, geographical distribution, and utilization of grasses and forage plants.

Office of Road Inquiry: Experiments in road engineering.

Office of Experiment Stations: Collection and dissemination of information regarding agricultural education and research in the United States and other countries. Supervision of coöperative investigations on the food and nutrition of man and on irrigation. Investigations on the agriculture of Alaska.

The Library: Contains 63,144 volumes, largely on agriculture and agricultural science. The library is engaged in the preparation of bibliographies of subjects in agriculture and agricultural science.

Publications: During the year ended June 30, 1898, the Department issued 501 bulletins and reports, the total number of copies being 6,280,365, exclusive of the Yearbook, which has an edition of 500,000 copies, and also of the publications of the Weather Bureau.

A. C. True.

THE BREEDING OF ANIMALS AT WOODS HOLL DURING THE MONTHS OF JUNE, JULY AND AUGUST.

During the month of June the temperature of the water continues the regular increase which begins on the first of April, and toward the end of the month reaches the temperature of 65° F. During July of the present year it fluctuated between 66° F. and 71° F., and during August it frequently registered 72° F.

With the increased temperature of the month of June there is a corresponding increase in the number of breeding animals; indeed, this month indicates the culminating point of reproductive activity of marine organisms at Woods Holl. The months of July and August are characterized by a constantly decreasing number of breeding animals, though the high temperature of the water is conducive to the rapid growth of innumerable larvæ.

Vertebrates.—Breeding lampreys have been taken at East Taunton as late as June 17, and the eggs hatch in from eleven to fourteen days. The smooth dog-fish, *Galeus canis*, frequently gives birth to 'pups' while confined in the 'fish cars' during this month. These young, beautifully marked, swim about with their parents, and do not seriously suffer from their restricted quarters. The fishermen say that the 'smooth dog' has two broods, and the observations made at the laboratories would indicate that this view is correct. The first brood is generally dropped during the early part of June, though during the latter part of the month a few females are often found with fully developed young. It is probable that, as soon as the young are born, mature eggs leave the ovary and pass into the oviduct, where they become fertilized. Professor W. A. Locy has removed eggs from the oviduct, which were in segmentation stages, from as early as June 22 to as late as July 4. Through the early part of July the embryos are small, but during August only advanced stages are found. The second brood may be dropped as early as August 10th.

The belief that the females after giving birth to their first brood immediately breed again is supported by Dr. Ayers, who has noted that there are congested placental spots on the uterine walls of individuals, the oviducts of which contain active spermatozoa, and Dr. Locy has noted that the ovaries contain certain large ova during June, whereas they contain only smaller eggs after the early part of July. No individual, however, is actually known to have given birth to two broods in a single summer.

The sand shark, *Carcharias littoralis*, the most common shark at Woods Holl during the summer, so far as I know, has never been taken during the breeding season, all the individuals being apparently immature. The spiny dog-fish, *Squalus acanthias*, though at times abundant during the early spring, has not been taken in sufficient numbers during recent summers to be of special value. Those desirous of collecting embryological material of this species have generally gone to North Truro, Province-

town or Lanesville. During the latter part of June segmentation stages and early embryos are found. During July embryos of about 1 cm. prevail. Early in August the embryos have reached a length of about 2 cm., and during the latter part of August embryos from 3 to 7 cm. in length are most abundant.

The common skate, *Raja erinacea*, is abundant during June, July and August, and at times fully a bucketful of eggs have been deposited in the 'fish cars' in a single night. The ripe females may be distinguished by the color of the lower side of the abdomen, through the thin walls of which the ova may be felt and even seen. Torpedoes with ripe eggs have not been taken. The short-nosed sturgeon, *Acipenser brevirostis*, is occasionally taken in June, the females bearing ripe eggs. The menhaden, *Brevoortia tyrannus*, breeds during the month of June, though no young were taken the present year. By the middle of July schools of young fish of about one inch in length are often to be seen.

Fundulus majalis continues its breeding during June and early July, and its eggs may be artificially fertilized with the sperm of *Fundulus heteroclitus*. The latter species breeds abundantly from the middle of May until the middle of July, but during the latter part of July and the first of August only a few ripe eggs can be secured. *Cyprinodon variegatus* spawns in June. *Lucania parva* is said to be viviparous. I do not know when it breeds. I am informed that late in July the female pipe-fish bears large ovarian eggs, and the males are still carrying embryos in their brood-pouches. Late in August both embryos and pouches have disappeared, and the ovaries contain only immature eggs.

Two species of *Menidia* (*gracilis* and *notata*) abound in the neighborhood of the laboratories. The following has been taken from notes kindly furnished by Dr. C. Judson Herrick: On June 5, 1896, Mr. Edwards found *Menidia notata* spawning at Hyannis in vast numbers. At this time the fish had selected a point in the beach grass above the low-tide level, and at low-tide the eggs were consequently exposed to the sun and dried. Mr. Edwards noted great quantities of spawn and milt, and collected about a quart of the former. During the last days of June and the first ten days of July of the present year the fish were very scarce, though Dr. Herrick found a few ripe females and a very few males. The eggs adhere to each other in thick ropy masses, and to any foreign object with which they come in contact, by means of long threads. Both fertile and unfertile eggs sink to the bottom, and the first cleavage plane appears in about one hour. The eggs may be artificially hatched in jars of running water, the period of incubation being ten days. The young fish, which carry a small yolk-sac, are about 6 mm. in length. Fry were skimmed from the surface of the harbor on July 4th, and measured 1.5 cm. in length. On July 9th fry similarly taken measured 2.25 cm. in length.

The eggs of *M. gracilis* resemble those of *M. notata*, but the species seems to breed later, since many ripe females were taken during the first week in July. The eggs, however, do not undergo artificial fertilization as readily as those of the first species.

The mackerel, *Scomber scombrus*, breeds during the middle and latter part of June, and generally at some distance from the shore. During the early part of the month of August of the present year myriads of young fish, about two inches in length, were found in the southern portion of Massachusetts Bay, showing that the breeding had taken place much nearer the shore than is usual. The butter-fish, *Rhombus triacanthus*, breeds during June. The white perch, *Morone americana*, breeds in May and June, and the sea-bass, *Centropristes striatus*, from

the middle of May to near the first of July. The scup, *Stenotomus chrysops*, spawns during early June, but the eggs do not all become ripe at the same time. Though thousands of squeteague were taken in the fish-trap during July, not a single individual contained spawn, and this was not surprising, for, according to Dr. Hugh M. Smith' spawning occurs about June. The cunner, *Tautogolabrus adspersus*, spawns during June and early July, and the bright colored young are abundantly found throughout the latter part of the summer. Ripe tautog, *Tautoga onitis*, were 'stripped' on June 15th and ripe eggs might have been taken until the middle of July. The 'puffers' are also summer breeders, the spawning season occurring early in June, after which the young are frequently taken in the skimming-net.

Since the establishment of the biological laboratories at Woods Holl the toad-fish has contributed to science with great generosity. Tin cans, broken bottles and shattered fragments of crockery are regularly planted by the collectors, and are regularly lined with large golden eggs. Oviposition occurs as early as June 3, and it may occur at any subsequent time throughout the month. According to Dr. Hugh M. Smith the blue-fish arrives about June 1st, at which time well-developed ova are found in a small proportion, and at Nantucket large roes have been found as late as July 15th. The first young blue-fish were taken at Woods Holl on June 10th, and measured from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in length. The young of the mullet, *Mugil curema*, $1\frac{1}{4}$ inches in length, were taken on June 28th. Both species of sea-robin breed during the early part of June. The eggs, not particularly transparent, readily develop in the laboratory and hatch in about five days. After the first of July females with eggs are seldom taken.

Among the Pleuronectidæ, *Bothus maculatus* breeds during early June, and the eggs may be artificially hatched, the period of incubation being about eight days. The young of 'flat-fish' were taken in the tow-net by Mr. S. R. Williams, from the 4th to the 17th of June, on which latter date they were most abundant. A few were also taken during the latter part of the month and during July. I have the following interesting note from Mr. Vinal Edwards: "A large school of young cod placed in the 'Eel Pond' directly from the hatching jars, in December last, left the pond in June when the water reached a temperature of about 60° F. They were at this time from 2 to $4\frac{1}{2}$ inches in length." The spawn of the goose-fish is occasionally taken near Menimsha. When a spawn is found, an abundance of embryological material results, since the eggs are united in a great jelly-like band that will more than fill a bucket.

The auftrieb is not rich in surface vertebrates during the summer. In June young hake, pipe-fish, lump-fish and herring occasionally occur. In early July young swell-fish, cunners, sticklebacks, tautog, sand-eels, silversides, hake and sand dabs; and during the middle of July the swell-fish, cunners, sticklebacks, silversides, sand-eels and hake are still conspicuous, though gradually disappearing from the surface as the season advances. By the middle of August only occasional specimens are taken.

Two species of land turtles are abundant in fresh-water ponds near the laboratories. The painted turtle, *Chrysemys picta*, breeds from June 11 to 25, and deposits its eggs in the evening, from 6 to 8:30 o'clock. The snapping turtle also breeds during the middle of June, but it deposits its eggs in the early morning.

Ascidians.—I am indebted to Frank W. Bancroft for many of the following notes respecting the breeding of ascidians.

Appendicularia were abundant near Gay Head on July 28th, and *Doliolum* is often taken at the same locality. Farther from

the shore several species of *Salpa* occur in abundance.

Among the simple ascidians, *Molgula* may be obtained in abundance from the woodwork in the harbor of New Bedford, and I think the eggs are ripe throughout the summer. *Cynthia partita* is apparently ripe throughout the month of July, at which time Dr. Bancroft also found ripe *Ciona intestinalis* and *Perophora viridis*.

Among the composite ascidians, *Botryllus gouldii* was found breeding from the sixth to the end of July, and almost all the older colonies contained either large ova or embryos. This species was not examined before the sixth, nor after the close of the month. Though several colonies of *Amaræcium stellatum* were examined, no large eggs or embryos were found during July, although *A. constellatum* frequently had large ova and embryos.

Crustacea.—There are several Brachyurans that carry eggs during the summer months. *Gelasimus minax*, *pugnax* and *pugilator* breed during the early parts of June, and females with eggs occur as late as July 2d, and perhaps later. *Sesarma reticulata* I frequently have found with eggs, but no specific data are at hand. *Pinnixa cylindrica* was found with eggs on July 13. *Pinnotheres maculatus* has been studied by Mr. F. P. Gorham, who found that the animals were very active at night, leaving the seclusion of the mantle-chamber of the mussel, and swimming and crawling about in the water in a most restless manner. On July 9 eggs in the earliest stages of development were taken, and from then until August 29 Mr. Gorham found all stages, though at the latter date egg-bearing females were relatively less abundant. *Panopæus* was found with eggs on June 7, and gastrulation stages were found on July 1. On July 8 all stages from four cells to complete embryos were noted, and on July 12 two females deposited eggs while in captivity. *Carcinus granulatus* was found with eggs, in late stages, June 25. *Platyonichus ocellatus* carried late stages on July 3. *Callinectes hastatus* was found with advanced embryos on August 3. *Libinia* has been seen to oviposit as late as August 7. *Pelia mutica* bears beautiful transparent eggs, which are in early embryonic stages the first week in July.

Among the Anomoura, *Hippa talpoida* carries eggs in the latter part of June and throughout the month of July. Mr. Gorham found early embryos and free-swimming young on August 9, 1896, and the characteristic Zoea are conspicuous in the skimmings throughout the month of August, being most abundant on the 22. Mr. M. T. Thompson found *Eupagurus longicarpus* with eggs until the middle of September. *E. annulipes* was not brought to the Laboratory before the early part of September, but at that time the females had eggs in varying stages of development. The breeding habits of *E. bernhardus* and of *E. pollicaris* were not noted, though the skimmings yielded an abundance of Zoea from the first of August throughout the month, and were probably present still earlier. The 'Glaucothoe stage' was first found on the 12th of August, and was frequent thereafter throughout the month.

Zoea of various species are conspicuous in the surface material from the first week in June, and Mr. S. R. Williams noted that when they were abundant they seemed to exclude 'Megalops' and *vice versa*.

Among the Macroura, *Gebia affinis* was found with advanced eggs on July 25. These hatched on August 7. *Callianassa stimpsoni* was found with eggs on July 1, and again on July 13. On the latter date the eggs were in segmentation stages. On July 18 other specimens bore advanced embryos which hatched on July 21. Dr. F. H. Herrick for several years had the opportunity of examining many

lobsters at the Fish Commission Hatchery, and concluded that the larger number of eggs were laid during the latter half of July and the first two weeks of August. These eggs are normally carried by the female until the following spring, when they hatch during May, June and July. I regret that I have no specific data on the breeding habits of *Crangon vulgaris*, but I have every reason to suppose that it is bearing and hatching eggs with its characteristic industry. Mr. F. P. Gorham found *Virbius zostericola* carrying eggs in all stages of development from the first of June to the first of September; the period of incubation lasts for about two weeks. *Palæmonetes vulgaris* was found with eggs in early stages of segmentation on June 20, and on the same date other individuals were found bearing late blastoderm stages and fully-formed embryos. The larvæ of *Palæmonetes* are excessively abundant in the auftrieb during July and August. The young of *Squilla* was occasionally taken in the tow-net during August, and was abundant on the surface of the Gulf Stream. A beautiful *Heteromysis*, bearing deep green eggs, was frequently dredged on the shelly bottom east of Nobsque during June and July. The young of *Cuma* were taken in the skimmings on June 14.

The Amphipods are by no means as abundant as during the spring. Mr. F. M. Watson found *Amphithoë compta* breeding through July and the first week or two of August and *Calliopius læviusculus* with eggs on August 1. *Orchestia agilis* was represented by innumerable young during the first two weeks in July; *Podocerus falcatus* was taken with eggs during the last two weeks of July and the first two weeks of August. Early in August a large number of Caprellæ bearing eggs were taken. *Talorchestia* has been found with eggs in late stages of development on June 14, and *Orchestia agilis* with eggs and embryos on June 20. A tube-dwelling amphipod, probably *Cerapus tubularis*, bears eggs, some of which are in early stages of development on July 4. *Hyperia* is frequently taken during June, and its large, almost absolutely transparent eggs would form excellent material for certain lines of biological research.

Among the Isopods, *Idotea robusta* was found with eggs on July 17, and again on August 12. Dr. J. P. McMurrich has found *Jæra marina* breeding in the middle of June, when his first observations were made, and from then without interruption until the first week in September, the time of his departure from the laboratory. *Tanais vittatus* was found with eggs in various stages of development early in August, and Dr. W. M. Wheeler has found the eggs of *Armadilidium vulgare* around old logs at Butler's Point late in June.

Copepods are, of course, abundant in all the surface material, and the parasitic Copepods found attached to the various fishes almost invariably bear egg-capsules which contain embryos in various stages of development. Attached to the floating seaweeds, boards, etc., which are washed on to the shore from the ocean are two or three species of 'goose barnacle,' which yield abundant embryonic material.

Dr. Wheeler found *Limnetis gouldii* breeding in small fresh-water ponds on Penzance, June 6–13, 1892. Associated with these were many specimens of *Eulimnadia agassizii* and *Bosmina*, both sexually mature.

The Pycnogonids breed during July, August and September. Dr. T. H. Morgan has recorded the appearance of *Tanystylum orbiculare* with eggs on July 1st; *Pallene empusa* carries eggs throughout the summer, and *Phoxichilidium maxillare* during August and September.

Limulus was found depositing eggs on June 19, and eggs were artificially fertilized on July 12, though the females were then nearly spent.

Vermes.—The breeding season of *Lepidonotus* and *Harmothoë* has passed. The eggs of *Sthenelais* may be artificially fertilized, and ripe individuals have been taken during the middle and latter part of August. *Podarke obscura* begins to oviposit about July 1. Dr. A. L. Treadwell has succeeded in artificially fertilizing the eggs by keeping the males and females in separate dishes until the sexual products are extruded, and then mixing in the ordinary way. *Autolytus* and other Syllids are frequently taken in the skimmings; the eggs are held in small spheres under the abdomen. *Nereis limbata* and *N. megalops* may be taken at the surface, in the evening, in great numbers and during the entire summer. The breeding habits of *Diopatra* are unknown, though the ova are nearly ripe in August. Though many specimens of *Marphysa* have been collected, the time of sexual maturity is not known. The breeding habits of *Anthostoma* and *Trophonia* are also unknown. Dr. A. D. Mead informs me that *Cirratulus grandis* breeds during July, and that the females will deposit their eggs while in confinement. The eggs are of fair size, but very opaque. Oviposition takes place in the evening. On the breeding habits of *Maldane* and *Cistenides* I have been unable to collect specific data.

Dr. Mead has spent a great deal of time in determining the breeding period of *Amphitrite ornata*, and after collecting about eight hundred specimens, at various times of the year, concludes that there is no definite breeding season. Between the first of June and the last of August only occasional individuals were found which yielded ripe sexual products. The eggs are extruded during the evening, and will not fertilize if artificially removed from the body cavity. *Scionopsis palmata* was found to bear eggs, apparently ripe, in August, but artificial fertilization was not attempted. The eggs of *Serpula* (*Hydroides*) may be readily secured by simply crushing the worm-tubes, and then placing the somewhat injured female in sea-water. As soon as the males are taken from the tubes the sperm will be seen to ooze from the nephridial openings. *Spirorbis borealis* is frequently found with eggs and embryos. From the latter part of June to the latter part of July the eggs of *Arenicola* may be collected by the bucketful. They are extruded in a jelly-like mass, sometimes two feet in length, and are especially abundant on the warm sand-flats of Buzzard's Bay.

Dr. Mead obtained the eggs of *Chætopterus* during July and August by cutting open the females. During the early summer of 1892 the larvæ of *Polygordius* were exceedingly abundant, and few specimens were taken during the past summer. *Sagitta* occurred occasionally. It was noted by Mr. S. R. Williams during the middle of June, and again at the close of the month and early in July.

Nectonema was occasionally brought into the Laboratory, and Dr. H. B. Ward has known it to extrude its eggs while in dishes of sea-water.

Dr. E. G. Gardiner informs me that he has taken the orange-colored eggs of *Polychærus caudatus* as early as June 6, and that they are abundant from June 15 to August 25. The eggs are deposited at night in transparent gelatinous capsules.

'Tornaria' larvæ are often taken during August in great abundance at flood tide, during both day and night.

Echinoderms.—Previous notes in SCIENCE have called attention to the early breeding habits of several representatives of this group. *Echinarachnius parma* continues to breed throughout June and the early part of July, and a limited number of eggs may be secured even during the later portions of the summer. *Arbacia punctulata* yields ripe eggs during the latter part of June, throughout July and a portion of August.

Strongylocentrotus was not carefully examined, though at Nahant I have often noted the extrusion of the yellowish, opaque eggs at various times during the warmer months.

The breeding habits of the star-fish are peculiar. Dr. A. D. Mead has found the breeding period to culminate in Narragansett Bay during the last week of June, although at Woods Holl no considerable number reached sexual maturity at any time during the past summer. In 1892 larvæ were abundant on June 18.

Mr. Caswell Grave paid particular attention to the Ophiurids during the past summer, and was successful in getting many ripe specimens of *Ophiopholis aculeata* at Nahant during the month of June. These he brought to the Laboratory in sea-water, artificially cooled, and they deposited their eggs and sperm between eight and nine o'clock in the evening of the day they were collected. The development was slow, the 'pluteus stage' being reached not until three weeks after fertilization, and several of the plutei lived to be thirty-three days old without showing signs of metamorphosis. Mr. Grave followed the development of the sexual glands of *Ophiura olivacea* with great care from the first of June, but the period of sexual maturity was not reached until the second week of July, when a limited quantity of fertilized ova was obtained. The larvæ proved to be quite different from those of any previously described Ophiuran. *Thyone briareus* and *Synapta inhærens* (= *Synapta girardii*) probably breed during June and July. I think the eggs have never been artificially fertilized. Echinoderm larvæ, which may have been brought to Woods Holl by currents, were abundant during the middle of June. Brachiolaria swarmed in Narragansett Bay from the last of June to the middle of July.

Mollusks.—During the first week of June the young of *Mytilus*, the 'sand-collars' of *Lunatia*, the 'eggs-strings' of *Sycotypus* and the 'egg-capsules' of *Urosalpinx* were noted in Narragansett Bay. During the second week of June, *Crepidula*, *Urosalpinx* and several naked Mollusks were found ovipositing. Dr. F. R. Lillie has collected eggs of *Pecten* from July 10 to August 4. On August 17 the breeding period had passed. According to Dr. Conklin the breeding period of *Crepidula fornicata* lasts from early summer until about August 15. The breeding period of *Crepidula plana* is somewhat later and longer, and newly laid eggs were found September 7. *Crepidula convexa* lasts through much the same period as *C. plana*. Dr. Lillie says that the unsegmented ova of *Unio complanata* can be obtained from about the middle of June to the middle of July, those of *Anodonta* toward the end of July and early in August. The 'Glochidia' of *Unio* escape in August and September, and the eggs of *Anodonta* are carried by the mother through the winter and are extruded in the spring.

Small squid were taken on the surface from June 20 to the close of the summer.

The clam, *Mya arenaria*, breeds during June and perhaps earlier. The height of the breeding season of the oyster is during the latter part of July, and the development is so rapid that the young swim in less than six hours after fertilization.

Mr. S. R. Williams, who kept a record of the surface forms during the past summer, found 'veligers' abundant on June 12, July 9 and July 19.

Cœlenterates.—*Cyanea arctica* has been taken with ripe eggs as late as June 3, though by the middle of the month only occasional specimens are seen. The eggs readily fertilize, and the young develop freely in the aquaria. The 'Ephyræ' of *Aurelia* were taken in the tow on June 15. The Scyphomedusæ are not abundant at Woods Holl during mid-summer, an occasional *Dactylometra* or an immature *Cyanea* being almost the sole representative of the

group. At New Bedford, and in Narragansett Bay, *Dactylometra* is excessively abundant, and one would probably have little difficulty in getting material for embryological study at almost any time. *Metridium* has frequently been seen to extrude its eggs, which may be artificially fertilized, and *Sagartia* has also been found breeding during the middle of July.

I am indebted to Professor W. C. Hargitt for many of the following notes on the breeding of Hydroids:

Clava leptostyla.—Colonies are occasionally taken from rock-weed in the 'Hole,' from June 18 to the end of the month, and less frequently throughout the summer. Colonies may also be taken from exposed timbers under the wharf of the U. S. Fish Commission. The male colonies are much more abundant and conspicuous.

Clytia bicophora, on the shells of *Mytilus*, with colonies of *Eudendrium*, is abundant late in June, when it is in a thrifty condition, and with mature gonangia.

Eudendrium. — Colonies of *Eudendrium*, probably *E. ramosum*, were taken in very imperfect condition June 17, apparently just beginning development from old stolons. Specimens were also taken from under the culvert at the outlet of the Eel Pond, on June 20, in a more vigorous condition, but with only male gonophores, which contained ripe spermatozoa. Colonies developed rapidly during the following ten days and produced female gonophores. The earliest signs of development of eggs occurred during the first week of July. The latest were recorded by Dr. Murbach, on September 15.

Corynitis Agassizii.—Specimens taken from the wharves of the Fish Commission on June 20, on shells of *Mytilus*, were in a thrifty condition and bore mature medusæ. These are set free during the early evening, and swim actively about the aquarium, though at this time there are no indications of sexual products. Several colonies of this interesting Hydroid were taken, but always from the encrusting deposit of a Bryozoon, which frequently occurs on the shells of *Mytilus*.

Hydractinia (*Echinata*) *polyclina.*—Colonies taken from the shells of Eupagurids, from rock-weed and from *Limulus*, were mostly sterile in June, or with only male gonads. It breeds during July and August.

Margelis carolinensis is quite common and in an excellent state of growth during June, though without medusa-buds. It is found on the timbers of the Fish Commission docks, on rock-weed and occasionally upon eel-grass. It breeds during August.

Obelia sp.—A species of *Obelia* is very abundant along the rock work and wharves, and during June develops apparently ripe gonangia, though few free medusæ.

Parypha crocea.—In splendid profusion and perfection throughout the month of June.

Pennaria tiarella.—During the month of June this species is to be found in limited numbers attached to rock-weed and to the piles of the wharves. Its development is slow, specimens with medusa-buds not being taken until June 29, During the following weeks the development is more rapid, both of the polyp-stock and of the medusæ. Dr. Murbach has found the species breeding as late as September.

Sertularia sp.—Everywhere in abundance, but with gonangia only in a few cases. Several species are found, of which the commoner are *Pumila* and *Argentea*.

Dr. McMurrich found *Laomedea amphora*, on Fucus, with ripe gonophores, June 2, and associated with it was *Halecium*, in a similar sexual condition. During the latter part of June and throughout the summer the medusæ of *Gonionemus* is found in great quantities in the Eel Pond. Mr. Williams noted *Clytia* and *Lizzia* in the sur-

face fauna during the second week of June, and medusæ of *Eucope* were found at various times during the summer. On July 28 an undetermined species of Hydromedusa was so abundant at Menimsha that a tumbler simply dipped into the ocean would be more than half filled with them.

Dr. Murbach has found *Corynitis* breeding during July and the early part of August, *Podocoryne* and *Hypolytus* during August.

Ctenophores, frequent during the early part of summer, literally swarm during the latter part of August. *Mneniopsis* is the most abundant species.

H. C. Bumpus.

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*AN AMPERE BALANCE.**

The Report of the Committee on Electrical Standards for 1897 ended with the following paragraph: "It thus appears to be a matter of urgent importance that a redetermination of the electro-chemical equivalent of silver should be made and that the general question of the absolute measurement of electric currents should be investigated * * *" This work we were asked by the Committee to carry out, and a grant of £75 was voted in its aid. We were thus led to examine into the methods which had been employed by Lord Rayleigh, Professor Mascart and others, for determining the absolute value of a current, as well as to consider some other methods which have not, as far as we know, been hitherto used.

After much consideration we decided to adopt a form of apparatus which, while generally resembling the type employed by some previous experimenters, possessed certain important differences; and, before expending any part of the grant of £75, to construct, without expense to the British Association, the following preliminary Ampere Balance.

On a vertical cylinder about 17 inches high and 6.8 inches in diameter we wound two coils, about 5 inches in height, separated by an axial distance of 5 inches. The coils consisted each of a *single* layer of about 170 convolutions of wire and were wound in opposite directions. From the beam of a balance there was suspended, inside this cylinder, a light bobbin about 4 inches in diameter, on which was wound a coil about 10 inches long, consisting of a *single* layer of 360 convolutions, and the whole apparatus was so adjusted that when the beam of the balance was horizontal the inner and outer coils were coaxial and the top and bottom of the inner suspended coil were respectively in the mean planes of the outer stationary coils.

This arrangement was adopted because with coils consisting of only one layer the geometrical dimensions could be accurately determined, and because the shapes of the coils lent themselves to the use of the convenient formula, readily expressible in elliptic integrals, for the force, F, between a uniform cylindrical current sheet and a coaxial helix, viz:

$$F = \gamma\gamma_h(M_1 - M_2),$$

where γ is the current per unit length of the current sheet, γ_h the current in the helix, and M_1 and M_2 the coefficients of mutual induction of the helix and the circular ends of the current sheet.*

The value of a particular current of about 0.63 ampere having been determined *absolutely* by means of this apparatus, the rate at which it would deposit silver under specified conditions was ascertained indirectly, by observing its silver value on a Kelvin balance which had been kept screwed down in a fixed position for several years past and which had been calibrated many times

* Read before the British Association.

* Proceedings of the Royal Society, Vol. 63, "On the Calculation of the Coefficient of Mutual Induction of a Circle and a Coaxial Helix, and of the Electromagnetic Force between a Helical Current and a Uniform Coaxial Circular Cylindrical Current Sheet," by Professor J. V. Jones.

during that period by reference to the silver voltameter.

The result of this preliminary investigation showed that the silver value of the *true* ampere was so nearly equal to the reputed value, viz., 1.118 milligram per second, as to require the use of an apparatus still more perfectly constructed, and, therefore, of a much more expensive character to enable the error, if any, in this value to be ascertained with accuracy.

We, therefore, started on the design of the instrument, of which we now submit the working drawings, and for the future construction of which we would ask for a grant of £300, including the unexpended grant of £75 voted last year.* And we anticipate that this new piece of apparatus may prove worthy of constituting a national Ampere Balance, the counterpoise weight for which will be determined purely by calculation based on the dimensions of the instrument, the number of convolutions of wire in the three coils, and the value of the acceleration of gravity at the place where the instrument may be permanently set up. In this particular it will differ entirely from the 'Board of Trade Ampere Standard Verified 1794,' which has had its counterpoise weight adjusted so that the beam is horizontal when a current passes through the instrument, which will deposit *exactly* 1.118 milligram of silver per second under specified conditions. In fact, the proposed Ampere Balance and the existing Ampere Standard will differ exactly in the same way as do a Lorenz apparatus and the 'Board of Trade Ohm Standard Verified, 1894.'

We have to express our thanks to Mr. Mather for taking charge of the construction and use of the preliminary apparatus, for checking all the calculations in connection with the determination of the electrochemical equivalent of silver that was made with it, as well as for superintending the making of the working drawings of the new Ampere Balance.

We have also to thank Messrs. W. H. Derriman and W. N. Wilson, two of the students of the City and Guilds Central Technical College for their cordial assistance in carrying out the work.

W. E. AYRTON,
J. VIRIAMU JONES.

* This grant of £300 has since been made.

NOTES ON PHYSICS.

ELECTRICAL VIBRATIONS.

IN *Wied. Ann.*, 1898, No. 11, M. Abraham gives a solution for the electrical oscillation of an ellipsoidal conductor (ellipsoid of revolution) and an approximate solution for the electrical oscillation of a straight rod. Perhaps the most interesting feature of the paper is the detailed analysis of the reflection of an electrical wire-wave from the free end of the wire.

The wave-length of the Hertz waves sent out from a vibrating rod are shown to be the double length of the rod, a fact which has been known experimentally for some time, and the overtones are harmonic.

It may be remembered that Tesla, a few years ago, suggested (and perhaps tried!) the use of electrical oscillations of the earth as a means of telegraphy. The solution of the problem of the electrical oscillation of a sphere was well known (?) at the time, and this solution indicates that to maintain the electrical oscillations of a sphere only a few inches in diameter would require *millions of horse-power*, and, of course, to stir up the earth electrically would require an enormously greater amount. Tesla did not succeed.

MANOMETRIC FLAMES.

PROFESSORS NICHOLS and Merritt publish, in the August number of the *Physical Review*, an interesting series of manometric-flame photographs. The reproductions are as good, perhaps, as is possible, but the original

negatives, which the writer has had the good fortune to see, are very fine, indeed, and show an amazing amount of detail in case of both consonant and vowel sounds. The photographs were taken by using acetylene burning in oxygen, an image of the flame being thrown upon a moving sensitive film.

ETHERION.

Nature, in acknowledging the receipt of a paper by Mr. Charles F. Brusch (*sic*) on the new gas *Etherion*, promises to "refer to the paper later when we receive a spectroscopic demonstration of the existence of the new gas." It seems to the writer that Mr. Brush has demonstrated the existence of a gas—or something thin like air—which has a thermal conductivity one hundred times as great as that of hydrogen. If such is the case, the gas is certaialy a new gas, and perhaps the spectroscope cannot be expected even to *verify* its existence; for Mr. Brush's speculation as to its molecular weight (1/10,000) is to a certain extent legitimate, and perhaps a gas of this molecular weight might not have any spectrum at all. One does, however, feel like demanding the demonstration of the existence of this substance by some of the methods heretofore employed in this field of discovery, but the fact remains that its thermal conductivity is sufficient to establish its existence. The only question in the matter is the accuracy of Mr. Brush's experimental results, and everyone who heard his paper at Boston was convinced of the adequacy of the experimentation. It may interest the readers of SCIENCE to learn that Professor E. W. Morley has joined Mr. Brush in continuing the investigation of the new gas.

THE GRAVITATION CONSTANT.

RICHARZ and Krigar-Menzel* have finished their elaborate and painstaking determination of the gravitation constant by means of the balance. A preliminary determination of the decrease of gravity with height, begun in '89, was reported to the Berlin Academy in '93.

The resulting value of the gravitation constant is

$$(6.685 \pm 0.011) \cdot 10^{-8} \frac{cm^2}{g \cdot sec^2},$$

and of the density of the earth

$$(5.505 \pm 0.009) \frac{g}{cm^3}.$$

This result lies between the results of Poynting and of Boys, and is, no doubt, the best result hitherto obtained; although the estimated probable error of Boys' result is only ± 0.002.

W. S. F.

* *Wied. Ann.*, Vol. 66, p. 177.

ZOOLOGICAL NOTES.

THE BRAIN OF THE CHIMPANZEE.

THE last number of the *Journal* of the Boston Society of Medical Sciences contains an article by E. W. Taylor on the Minute Anatomy of the Oblongata and Pons of the Chimpanzee. The author calls attention to the fact that, while the gross anatomy of the anthropoid apes has received much attention, comparatively little has been done in the way of minute study, and says that particular study should be given the cortex, in which the final secret of the differentiation of brain types must lie. The methods of preparation of the sections are given, and then follows a detailed description and comparison with similar sections of the oblongata and pons of man.

The points of special interest in the oblongata are the great development of the motor tracts; the peculiar conformation of the gray matter; the irregular character of the sensory crossing, and the smallness of the fillet; the fewness of the external ventral arcuate fibers, and the absence of the nucleus arciformis; the large size of the descending root of the fifth nerve and the imperfect development of the restiform body.

The noteworthy features of the pons are the preservation of the identity of the pyramidal tracts; the fewnesss of the essential fibers of the pons; the greater relative development of the dorsal portions and the insignificance of the posterior longitudinal fasciculus.

Mr. Taylor concludes that "There can be no question from our study, as well as from that which has gone before, that the similarity between the brain of the anthropoid apes and of man is one of the most striking and interesting facts of which we have knowledge."

FRESH-WATER PEARLS OF THE UNITED STATES.

MR. GEORGE F. KUNZ'S paper on the Fresh-water Pearls and Pearl Fisheries of the United States, recently issued by the United States Fish Commission, is of very general interest. The early history of Unio pearls in North America is given, and the extent to which they were used as ornaments by the aborigines will be a surprise to many. Enormous numbers have been found in the mounds of Ohio, one opened by Mr. Moorehead containing 'a gallon of pearls,' and another excavated by Professor Putnam nearly two bushels. It may be added that through the length of time they had been buried their value from a commercial standpoint had been lost. The various pearl-gathering fevers that have, from time to time, prevailed in different localities are described, and one can scarcely wonder at them when the chance of making a lucky 'find' is considered, even though, as in other lotteries, the blanks far outnumber the prizes. The pearl-button industry which has arisen in some of the Western States has assumed considerable proportions, employing over 1,500 people, and, between the search for pearls and the use of the shells for making buttons, the Unios in many localities are threatened with extermination.

THE WASHINGTON MEETING OF THE AMERICAN ORNITHOLOGISTS' UNION.

THE recent meeting of the American Ornithologists' Union—as may be seen by the report of Secretary Sage in the last number of this JOURNAL—was characterized by the large number and wide scope of subjects covered by the papers presented, ranging as they did from those of a popular nature to the strictly scientific. Among the former Mr. Chapman's delightful description of a visit to the Bird Rocks of the Gulf of St. Lawrence easily stands first, accompanied as it was by fine illustrations of the feathered inhabitants of this ancient and historic bird colony. Although the numbers of birds have sadly diminished since Jacques Cartier wrote that these islands are as full of birds as any meadow is of grass, yet enough remain to make a goodly showing, and the white lines of nesting gannets still form an impressive sight.

Dr. T. S. Roberts, of Minneapolis, and Mr. W. L. Bailey, of Philadelphia, exhibited a number of views of birds and their nesting places, some of them veritable triumphs of patience and ingenuity over natural obstacles. This photographing of wild birds and the study of their habits cannot be too strongly commended to our younger ornithologists, not only because it furnishes plenty of good work near home, fraught with no harm to the birds, but because we need to know much more than we do of the habits and life histories of even our commonest birds. The Robin, for example, is a bird so common as almost to be treated with contempt, and yet Mr. Brewster and Mr. Widmann have shown us how much there is of interest about it.

Mr. Witmer Stone, on the part of the Committee on Bird Protection, presented an extensive report encouraging as indicating the growth of sentiment throughout the country. Unfortunately, however, the question of protecting the birds is much

like the temperance question, depending more upon public sentiment than upon law, since laws are inoperative without public approval to enforce them. So long as fashion demands feathers and there are birds to supply them, so long will feathers be worn, and it is to be doubted if laws directed against the wearing of feathers would be held constitutional. Attention was justly called to the collecting fad which possesses so many of our younger ornithologists, and which in its worst phases is not a whit better than the collecting of postage stamps, only to see how many may be obtained. The mere possession of any number of bird skins and bird eggs no more makes an ornithologist than the owning of paints and brushes constitutes an artist, yet it is evident from the abundant catalogues of dealers in bird skins and eggs that there is far greater demand for these than the needs of ornithology warrant. From a scientific standpoint Dr. Jonathan Dwight's observations on the moulting of birds and Mr. William Palmer's on the early stages of feathers were the most important presented, dealing as they did with subjects concerning which we have much to learn, and which have important bearings on the phylogeny and classification of birds. While these subjects have both been worked at in a more or less desultory way, we need a large number of carefully accumulated facts on both points. Mr. Palmer presented a genealogical tree and scheme of classification based on the condition of the neossoptiles, or first feathers, but this is to be regarded as purely tentative. While birds must be classified by the resultant of a number of characters, and not by any one or two, yet Dr. Gadow has pointed out the value of taxonomic arrangements based on a single character, since each will contribute something good; therefore, it is to be hoped that Mr. Palmer will continue his work.

F. A. L.

CURRENT NOTES ON ANTHROPOLOGY.

ORIGIN OF NEOLITHIC ART IN FRANCE.

M. Gabriel Carrière has an article in *L' Anthropologie*, August, 1898, on the palethnology of southern France, in the course of which he makes some important general statements. The same population, ethnically, continued after the neolithic period through the bronze age. The introduction of metal was not accompanied by conquest and a change of physical type. The constructors of the dolmens and other megalithic monuments developed their own culture, and their remains have not yielded a single object to which one should attribute an oriental origin, or class with the art products of Hissarlik, Mycenæ or Egypt.

This conclusion is fully in the line of many recent researches in western Europe, which dispel the old notion that its primitive culture was introduced by Phenician, Greek or Egyptian navigators.

PALÆOLITHIC STATIONS IN RUSSIA.

Deposits which can be referred to the Palæolithic period are excessively rare in Russia; indeed, some archæologists deny that any have been found. One rather promising site is on the right bank of the river Dnieper, close to the city of Kiew. In a gravel deposit there, directly overlying the tertiary clay, and at a depth of 19 meters below the surface, M. Chvojka unearthed bones of the mammoth and cave bear, along with flint chips, charcoal and dressed stones of rude form. While the finder believed the deposit of inter-glacial origin, Professor Armachevsky, of the University of Kiew, places it post-glacial; and the types of stone implements, according to M. Volkov, who reports the facts, are not extremely ancient, but point rather to the period of transition from the palæolithic to the neolithic, of which latter period well-marked remains exist in the same locality. This station, therefore, is not certainly very

ancient (Bull. de la Soc. d'Anthropologie de Paris, 1898, Fasc. 2).

THE STIGMATA OF DEGENERATION.

THIS is the title of an article of thirty-five pages by Dr. W. C. Krauss in the *American Journal of Insanity*, July, 1897, of great merit. There is no question in anthropology of more actual interest than that of Degeneration, what it is, what it means, what are its signs. In one sense, every step of progress involves degeneration, while in another sense, degeneration is the antithesis of progress. There is no such thing as 'the normal type,' the perfect man, and never was. What some writers assert is the acme of perfectibility—complete adaptation to environment—is, in fact, typical degeneration and a pathological condition.

Dr. Krauss treats very fully the stigmata of degeneration, first the physical, and next the mental or psychical and moral, and concludes with an attempt to answer the question: Is the human race degenerating? He replies with a negative, and adds the pleasing information that, 'as compared with foreigners, Americans exhibit the fewest signs of degeneracy, and the most marked degenerate types found here are imported individuals.'

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

SCIENTIFIC NOTES AND NEWS.

THE 'HUMANE' SOCIETY.

THE current issue of the *Philadelphia Medical Journal* contains an interesting article by Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, on diseases and abuses of animals in the United States, describing what has been done by the federal government towards their alleviation and prevention, and what the Humane Societies of the country may do to assist in these efforts. This address was prepared at the request of the officers of the American Humane Society to be read at their present meeting in Washington. But the Washington Humane Society protested that if Dr. Salmon's name were not removed from the program they would lose all interest in the meeting, and the paper was omitted. The Chairman of the Subexecutive Committee wrote to Dr. Salmon that he was deeply humiliated by the action of the Society, and to this letter Dr. Salmon replied as follows:

Your favor of the 21st instant is received, and I assure you there is no cause for you to feel embarrassment on my account. It is remarkable, however, that the Washington Humane Society should so greatly fear the reading of a paper before your body, upon such a practical subject as I was to present, that it would lose all interest in the meeting in case that part of the program were carried out. If the cause which they are advocating would be so seriously endangered by one man and one paper, with a convention predisposed in their favor, should not this confession of the fact prove embarrassing to them rather than to any one else?

The Washington Humane Society is making a great effort to secure legislation to stop experimentation upon animals even for the advancement of medical science. In this I sincerely hope they will never succeed; but they are alienating from cooperation with the humane societies the great humane forces of the country, viz., the medical and veterinary professions, the biologists, the universities and the Agricultural Department of the Government. In the meantime the value of such experimentation is becoming more and more apparent, and we are slowly learning, by means of it, how to control the destructive diseases affecting mankind and the lower animals. This Bureau has distributed, upon request of the owners of cattle, 500,000 doses of blackleg vaccine during the past year, reducing the loss from about 15 per cent. to 1 per cent. This year we have demonstrated that Texas fever can be prevented without serious restriction to the traffic in Southern cattle, and this discovery will save millions of dollars annually to the people of the Southern and Southwestern States and Territories. We are also introducing a serum treatment for hog cholera which saves 80 per cent. of the animals in diseased herds. These discoveries, made by experimenting upon animals, mean not only many millions of dollars to the country, but they mean the cheapening of the food supply, which is always equivalent to saving human suffering and prolonging human life, and they also mean the prevention of infinite suffering among the species of animals affected by these diseases.

Under these circumstances is it not time for the

liberal and intelligent members of the American Humane Association, who joined that organization to prevent cruelty to animals rather than to secure personal notoriety, to stop and consider whether they are called upon to further support and encourage those narrow-minded and intolerant people whose efforts are a hindrance rather than an aid to the cause of humanity.

Assuring you again of my appreciation of your invitation, and of my sympathy with every intelligent effort for lessening the great sum of misery and suffering to which both our own race and the lower animals are subject, I am, etc.

THE SEVENTH INTERNATIONAL GEOGRAPHICAL CONGRESS.

It will be remembered that at the Sixth International Geographical Congress held in London in 1895 two invitations were presented for the next meeting, one from the United States and one from Germany. The latter invitation was accepted, and the Geographical Society of Berlin, which is assisted by a General German Council, undertook to carry out the necessary preparations. The London *Times* states that invitations are now being issued to the friends and promoters of geography in all countries, and especially to the members of all geographical societies and cognate scientific bodies. The meeting of the Congress will take place from Thursday, September 28, to Wednesday, October 4, 1899. Before the beginning and after the close of the Congress excursions will be arranged through such parts of Germany as may be of interest with regard to physical or economic geography. The Geographical Society of Hamburg will issue invitations for a visit to that city under the auspices and with the sanction of the Senate. Further information respecting the organization and the general program of the Congress will be issued as early as possible.

The subjects which may be treated or discussed at the Congress are embraced in the following groups: (1) Mathematical Geography, Geodesy, Cartography, Geophysics; (2) Physical Geography, Geomorphology, Oceanography, Climatology; (3) Biological Geography; (4) Industrial and Commercial Geography; (5) Ethnology; (6) Local Geography, Exploring Travels; (7) History of Geography and of Cartography; (8) Methodology, School Geography, Bibliography, Orthography of Geographical Names. It is probable also that some step may be taken to render the work of the Congress more continuous and permanent. Something was done in this direction at the London meeting, but, as the committee of the Congress have no funds at their disposal, it is difficult to carry out any practical work. Some attempt may, therefore, be made to institute a fund out of which grants may be made for special purposes, as is done by the British Association.

The subscription for membership is £1 for either ladies or gentlemen. Members will receive all publications of the Congress free of charge. Ladies accompanying members are also admitted as associates on payment of 10s. All who wish to contribute communications to the Congress are requested to give notice before April 1, 1899, and to send their manuscripts to print not later than June 1, 1899. The time allowed for each discourse or paper will, as a rule, not exceed twenty minutes, but exceptions may be made in the case of subjects of general interest or importance.

According to custom, the English, French, German and Italian languages are admitted as languages of the Congress, and all papers must be written in one of them. All propositions, applications, notifications and manuscripts of papers which are addressed in due time to the Congress will be submitted for examination to a special committee, and, if found suitable, incorporated in the general program, so far as the time at disposal shall allow. If it is desired that full notice of any communication thus admitted be given in the daily bulletin which is to be published during the meeting, an abstract of it, not exceeding 1,500 words, must be delivered before August 1st. Any motion to be laid before the Congress must be formulated in writing, and should be transmitted not later than June 1, 1899. All correspondence relating to matters of the Congress is to be addressed 'To the Seventh International Geographical Congress, 90, Zimmerstrasse, Berlin, S. W.'

STATE OWNERSHIP OF THE TELEGRAPH AND THE TELEPHONE.

The presidential address given by Mr. W. H. Preece, C.B., F. R. S., before the British Insti-

tution of Civil Engineers, on November 1st, is of such interest that we regret that limits of space do not permit its publication in full. The government of the United States must soon face the problem of the control of the telegraph and telephone, and the account given by Mr. Preece of the condition of affairs in Great Britain may be quoted. He says: "I was sent, in 1877, together with Sir Henry Fischer, to investigate the telegraph system of the American continent, and especially to inquire into the accuracy of the incredible report that a young Scotchman named Bell had succeeded in transmitting the human voice along wires to great distances by electricity. I returned from the States with the first pair of practical instruments that reached this country. They differed but little from the instrument that is used to-day to receive the sounds. The receiver, the part of the telephone that converts the energy of electric currents into sounds that reproduce speech, sprang nearly perfect in all its beauty and startling effect from the hands of Graham Bell. But the transmitting portion, that part which transforms the energy of the human voice into electric currents, has constantly been improved since Edison and Hughes showed us how to use the varying resistance of carbon in a loose condition, subject to change of pressure and of motion under the influence of sonorous vibrations. The third portion, the circuit, is that to the improvement of which I have devoted my special attention. Speech is now practically possible between any two postoffices in the United Kingdom. We can also speak between many important towns in England and France. It is theoretically possible to talk with every capital in Europe, and we are now considering the submersion of special telephone cables to Belgium, Holland and Germany. The progress of the use of the telephone in Great Britain has been checked by financial complications. It fell into the hands of the company promoter. It has remained the shuttlecock of the Stock Exchange. It is the function of the Postmaster-General to work for the public every system of inter-communication of thought which affects the interests of the whole nation. Telephony is an Imperial business, like the Post and the Telegraph. It ought to be in the hands of the State. * * * Two causes exist to impede this desirable absorption, the fear of being 'done' by watered and inflated capital, and the assumed bad bargain made in absorbing the telegraphs in 1869. The former is a mere bugbear. The public does not want to purchase stock. It wants to acquire a plant and business, which can be easily and fairly valued. The latter is a gross fallacy. The business of the telegraph companies — practically an unlimited monopoly — was purchased on absolutely fair terms, viz.: 20 years' purchase of the net profits. The sum paid was £4,989,048. The number of messages then sent in one year was about 5,000,000, and the gross income about £500,000. The income has now grown to £3,071,723, the number of messages has reached 83,029,999, and the capital account which was closed in 1891, viz.: £10,131,129, including the cost of the Post Office extensions, remained the same. If a syndicate desired now to re-purchase the business and acquire the plant they would have to find a capital of over £30,000,000. In what respect, then, was the transfer of the telegraphs to the State a failure? Our magnificent system has been built virtually out of revenue; our tariff is very cheap; scarcely a village of any consequence is without its telegraph; our press is virtually subsidized by having its news supplied at much less than cost price; we can rely upon safe and accurate delivery and upon speedy despatch of messages. We lead the world. There has been no failure and there was no bad bargain.

GENERAL.

LORD LISTER, President of the Royal Society, has addressed an official letter to the Paris Academy of Sciences, asking its opinion as to the advisability of forming an International Scientific Association, representing the chief scientific academies and societies of the world. The Paris Academy has decided to discuss this question in a secret session.

PRESIDENT PUTNAM has called a meeting of the Council of the American Association for the Advancement of Science, on Tuesday, December

27th, at 4 p. m., in Schermerhorn Hall, Columbia University, New York City.

The Dutch Academy of Sciences has elected the following foreign members: Professor E. C. Pickering, Harvard University; Professor W. C. Röntgen, Würzburg; M. L. V. Delisle, Paris, and Professor F. E. Thorpe, London.

The French Academy has elected as correspondent in the section of mineralogy M. Deperret, who has been for many years professor at Lyons, and is the author of numerous contributions to geology and paleontology. The other nominees were M. M. Gonnard, O'Ehlert and Péron.

Professor A. S. Packard has been given leave of absence from Brown University, and will spend nine months in a trip to Egypt, Palestine and the countries on the Mediterranean.

Professor Josiah Royce, of Harvard University, leaves New York on December 20th for Aberdeen, where he will give the Gifford Lectures on 'Natural Religion.' He will return to America in February.

Professor A. H. Church has been elected President of the Mineralogical Society, London.

Professor Koch, who, as we have already stated, has been spending several months investigating malaria at Rome, now proposes to return to Africa to continue his studies on the subject.

The anniversary meeting of the Royal Society was held on November 30th, and the annual dinner on the evening of the same day. Officers were elected and medals conferred in accordance with the arrangements that we have already announced. Lord Lister referred to the Fellows of the Society who had died during the year, of which there were sixteen, and described the advance of science more especially as related to the activities of the Society. At the dinner in the evening, speeches were made by the Lord Chancellor, the Bishop of London, Lord Lister, Professor Oliver Lodge, Lord Curzon and Lord Kitchener.

The U. S. Fish Commission steamer *Fish Hawk* is expected to leave Norfolk this week for Porto Rico, where it will remain during the winter. The party it carries will make a careful study of the various forms of life in the waters about the island, and incidentally the fauna and flora of the land will be studied and collections made in various branches of natural history. On the return of the steamer the material gathered will be submitted to specialists, and their united papers will form a comprehensive report on the natural history of the island. The presence of Mr. A. H. Baldwin as artist to the expedition ensures good illustrations and will make it possible to obtain figures of many marine animals colored from life. Professor B. W. Evermann is in charge, and he will be assisted on the part of the Fish Commission by Mr. H. F. Moore, E. C. Marsh and others. Entomology will be cared for by Mr. August Brusck, of the Department of Agriculture, while Mr. A. B. Baker will represent the National Zoological Park.

The authorities of the American Museum of Natural History have consented to open the Museum to members of the scientific societies visiting New York on Tuesday, December 27th, although ordinarily the Museum is closed on Tuesdays. On presenting a card to any of the curators, the visitor will be personally shown the objects that may specially interest him.

Thomas Sanderson Bulmer, M.D., C.M., F.S.A., died by suicide, at Sierra Blanca, Texas, on October 5th. He has pursued amateur researches in American archæology and ethnology for several years; he made contributions of some note to Pilling's bibliographies of Indian linguistics; during the past year he made journeys through northern Mexico, visiting ruins and collecting information concerning Indian tribes.

Dr. Ewald Geissler, professor of chemistry in the Veterinary School at Dresden, died on October 15th, aged fifty years.

Mr. Edwin Dunkin, F.R.S., the distinguished astronomer, died on the 26th inst. in Kidbrooke-park-road, Blackheath. The London *Times* states that he was the third son of Mr. William Dunkin, of the 'Nautical Almanac' office, and was born at Truro in 1821. After being educated partly in England and

partly in France, he joined the staff of the Royal Observatory at Greenwich in 1838, and remained there for 46 years, being promoted successively to be First-class Assistant and Chief Assistant. During this period he represented the Astronomer Royal in several important expeditions, notably the observations of the total solar eclipse at Christiania in July, 1851, and the determination of the telegraphic differences of longitude between the Royal Observatory and the observatories in Brussels, Paris and Valencia, in Ireland. Mr. Dunkin had the sole charge of the Astronomer Royal's pendulum experiments, undertaken to determine the mean density of the earth, at the Harton coalpit, near South Shields, in 1854. Elected a Fellow of the Royal Astronomical Society in 1854, he served as Honorary Secretary from 1871 to 1877, and in 1884 he was chosen President. He was elected a Fellow of the Royal Society in 1876, and from 1879 to 1881 was a member of the Council of the Society. Mr. Dunkin published a number of works on astronomy, including 'On the Probable Error of Transit Observations,' 'The Midnight Sky,' 'Familiar Notes on the Stars and Planets,' 'Obituary Notices of Astronomers,' and a work on the movement of the solar system in space determined from the proper motions of 1,167 stars. In addition he contributed from time to time to various scientific and other periodicals.

WE take also from the London *Times* the following particulars in regard to the work of Professor George James Allman, whose death we were compelled to record last week: He devoted the greater part of his life to investigating the lower organisms of the animal kingdom. For his researches in this branch of biology he received in 1872 the Brisbane prize from the Royal Society of Edinburgh; in the following year a Royal medal was awarded to him by the Royal Society of London, and in 1878 he received the Cunningham gold medal from the Royal Irish Academy. He was appointed by the government in 1876 one of the Commissioners to inquire into the condition of the Queen's Colleges in Ireland, and soon after his election to his professorship in Edinburgh he was appointed one of the Commissioners of Scottish Fisheries. The latter post he held until the abolition of the Board in 1881. When Mr. Bentham resigned the presidency of the Linnæan Society Professor Allman was elected, and he retained the position until 1883, when he resigned in favor of Sir John Lubbock. He He was President of the British Association for the Advancement of Science in 1879. The large collection of Hydroida made during the exploring voyage of the Challenger was assigned to Professor Allman for determination and description. He had previously dealt in a similar manner with the Hydroida collected during the exploration of the Gulf Stream by the United States government. Professor Allman has served on the Councils of the Royal Societies of London and Edinburgh, and of the Royal Irish Academy, and has filled the post of Examiner in Natural History for the Queen's University of Ireland, the University of London, the Army and Navy and Indian Medical Services, and for the Indian Civil Service. He has published the results of his original investigations in the Philosophical Transactions, the Transactions of the Royal Society of Edinburgh, of the Royal Irish Academy, and of the Linnæan and Zoological Societies of London. Other of his original contributions took the form of reports to the British Association, to the Museum of Comparative Zoology, Harvard University, and to the Commission of the Challenger Exploration, and of communications to the *Annals of Natural History*, the *Quarterly Journal of Microscopic Science* and other scientific publications. His larger works were : 'A Monograph of the Fresh-water Polyzoa,' 1856, and 'A Monograph of the Gymnoblastic Hydroids,' 1871–72, both published by the Ray Society.

MR. C. B. CRAMPTON has been appointed Assistant Keeper in the Geological Department of the Manchester Museum.

DR. KARL FREIHERR VON TUBEUF, Privatdocent at Munich, has been called to the newly established Division for Agriculture and Forestry in the Royal Department of Health, Berlin.

THE Alvarenga prize of the Philadelphia College of Physicians, of the value of about $180, has been awarded to Dr. S. A. Knopf, of New York City, for an essay on pulmonary tuberculosis.

M. Bischoffsheim has undertaken to construct and endow an observatory to be placed on Monte Cinto, in the Island of Corsica. Surveys are at present being made, with a view to finding the most suitable site for the observatory.

M. Chauchard, who gives annually large sums for public purposes, has this year set aside 130,000 fr. for various Paris institutions and charities, 10,000 fr. being for the Pasteur Institute.

The late William E. Hale, of Chicago, has bequeathed $300,000, to be held in trust, the income to be used for public purposes at the discretion of the trustees.

Mr. T. B. Blackstone, of Chicago, who gave more than $500,000 for the erection and endowment of a library at Brandford, Conn., has now added $100,000 to its endowment.

A biological station has been established on Lake Bologoy by the Society of Naturalists of St. Petersburg.

A grant of £25 from the Craven University Fund, Cambridge University, has been awarded for the purpose of assisting George B. Grundy, M.A., Brasenose College, to complete surveys and explorations, mainly in northern Greece.

Natural Science states that Mr. Alan Owston, of Yokohama, has recently sent to England a magnificent collection of hexactinellid sponges from the seas of Japan. Most of these have been purchased by the Trustees of the British Museum, but a fair number have gone to Oxford. Among the specimens are many studied by Professor Ijima for the monograph that he is writing on the group.

An expedition has been sent from France to explore the upper course of the Cavally River, which separates the Republic of Liberia from the French possessions. The French government is also about to send a hydrographic expedition to make surveys of the coast of Madagascar.

Professor McMurrich, of the department of anatomy of the University of Michigan, has recently been asked by the authorities of the Bremen Museum to investigate a collection of actinia, commonly known as animal flowers or sea-anemones, obtained from the south Pacific islands. This offer he was regretfully compelled to decline, as he is at the present time engaged in the study of a similar collection from the coast of Chili, made by the authorities of the Royal Museum of Natural Sciences of Berlin.

The committee of the Royal Society appointed to investigate the Tsetze-fly disease, consisting of Professor Kanthack, Mr. H. E. Durham and Mr. W. H. Blandford, have made a report showing that the parasite is capable of infecting a larger variety of animals than was previously supposed, and giving some details in regard to methods of infection, but they have not been able to discover a preventative or cure.

The arrangements for providing a school of tropical medicine at the branch hospital of the Seaman's Hospital Society, Victoria and Albert Dock, London, E., are, says the *British Medical Journal*, making satisfactory progress. A subcommittee, consisting of Mr. Nairne, Chairman; Sir C. Gage Brown, K.C.M.G.; Mr. Macnamara, Dr. Lauder Brunton, Dr. Stephen Mackenzie, Dr. Manson, Dr. James L. Maxwell, Mr. Johnson Smith, F.R.C.S.; Mr. William Turner, F. R.C.S., and Mr. James Cantlie, F.R.C.S., is now engaged in drawing up a constitution for the school and defining the curriculum. The new buildings will, it is expected, be completed by October 1, 1899, and it is announced that Mr. Chamberlain intends to preside at a festival dinner to be held during the coming Parliamentary session. A valuable collection of paintings of skin diseases and ulcers, common in British Guiana, has been presented to the school by Dr. D. Palmer Ross.

A correspondent of the London *Times* telegraphs from Bombay that the hearing of evidence before the Plague Commissioners began on November 29th. The first witness was Mr. A. Wingate, Acting Chief Secretary. He gave a history of the plague in the Bombay Presidency. Segregation in the small towns had destroyed the plague, but it was impossible in the big towns on account of the requirements of trade, though it had been advantageous in certain wards of some towns. The shortest time during which evacuation of villages had been

enforced was three weeks, and the longest three months. Dr. Haffkine was next examined. He described the constituents of his plague prophylactic, the method of its application, and the general result. After the sittings at Bombay the Commission will proceed to Calcutta, which will be reached about Christmas. Having taken evidence in the Northwestern Provinces and the Punjab as to the outbreaks, the Commissioners will visit Sind, ultimately returning to the Bombay Presidency, where the proceedings are likely to be protracted, as this has been the principal seat of the epidemic.

PRESIDENT MCKINLEY'S message to Congress contains almost no reference to the scientific work under the government. It is said in regard to forest reservations that at the close of the year thirty forest reservations, not including those of the Afognac forest and the fish-culture reserve in Alaska, had been created by Executive proclamations under Section 24 of the Act of March 3, 1891, embracing an estimated area of 40,719,474 acres. The Department of the Interior has inaugurated a forest system, made possible by the Act of July, 1898, for a graded force of officers in control of the reserves. This system has only been in full operation since August, but good results have already been secured in many sections. The reports received indicate that the system of patrol has not only prevented destructive fires from gaining headway, but has diminished the number of fires.

DR. ERWIN F. SMITH, of the Department of Agriculture, has been investigating the peach orchards of southwestern Michigan which are suffering from a damaging disease known as 'little peach.' The symptoms of the disease are: (1) dwarfing of the fruit; (2) retarded ripening of the fruit, or at least absence of any premature ripening; (3) absence of any red spotting of skin or flesh; (4) dwarfing or yellowing of the foliage from start; (5) absence of the sprouting winter buds. Dr. Smith concludes that the disease is due to a shutting-off of the water supply, but whether this is brought about by some parasite, or by droughts combined with overbearing and with unsatisfactory soil or subsoil conditions, can only be determined by long and careful study.

MR. FREDERICK W. CHRISTIAN, after an absence of nearly nine years, has recently returned from his explorations in the Caroline Islands. We learn from the London *Times* that Mr. Christian stayed nearly three years in Samoa, studying the language and customs of the peoples, especially those who are farthest removed from the settlements of the white man. In Tahiti and the Marquesas he spent two years, carefully and minutely studying and noting down the language, the genealogies, folklore and traditions of the inhabitants. He visited single-handed Spanish Micronesia, in order to obtain some further and minuter information upon certain mysterious ruins reported to exist upon Bonate, or Ponape, and Lele, two islands lying farther to the eastward of the extensive Caroline chain. The results of Mr. Christian's explorations were as follows: A Pampanga native, since executed by the Spanish for joining the late Philippine rebellion, took some 150 photographs in the districts of Kiti, U, Metalanim, Not and Chokach (wrongly styled Jekoits and Jokoits in the present charts). The walled islets of Nan-Matal, the mysterious Venice of Micronesia, were explored and mapped out fairly accurately. The phonesis of very many native names and their spelling were changed from a meaningless jargon to their correct native renderings and accompanying significations. He also made excavations in the central vault of the sanctuary of Nan-Tanach, bringing to light a considerable number of curious tools, implements and shell ornaments of an ancient date. Many of the old native legends and fairy tales were rescued from oblivion. Some new information was obtained about the flora and marine life of the archipelago. The former presence of an early Negrito race, conquered and absorbed or overlapped by later waves of Polynesian, Malayan and Melanesian immigrants was fairly established. Also evidence was collected as to the obtrusion of many Japanese words upon the Micronesian area. This was elaborately demonstrated by an exhaustive list of 450 English keywords—nouns, verbs and adjectives—in the various Micronesian dialects. Mr. Christian

spent some three months upon Yap, in the western Carolines. Some of the ancient platforms and burial places—of a Japanese design—and the remarkable village council lodges were sketched. After putting the results of his work on record through the Royal Geographical Society and otherwise, Mr. Christian intends to revisit the Carolines and Mariannes, taking particular notice of Ruk, Tinian, Saipan, Pulawat and Nuku-Oro and the Pelew Islands.

Consul Mayer writes to the Department of State from Buenos Ayres, under date of October 12, 1898: The locust advices are not reassuring, as, though the extinction goes on briskly, the invasions are tremendous, and it is apprehended that they will soon be in the Province of Buenos Ayres. Entre Rios and parts of Santa Fé and Cordoba are overrun. In the first three days of October 398 tons of locusts were gathered in Entre Rios alone; but the sub-commissions complain that in some quarters the inhabitants refuse to work at the extinction, and that the police does not lend its authority to compel them. The central commission has issued a circular urging that prompt notice be given of all desoves (egg despositing) and samples sent in, with dates and all other particulars pertinent. The news from Paraguay is that the locusts are thick there and doing wholesale damage. In the colonies south of Santa Fé there have been no invasions as yet, and the farmers are of the opinion that if they escape until the 15th instant both wheat and linseed will be safe. The Jewish colonies in Villaguay have been invaded and the crops destroyed. The colonization company owns 70,000 hectars there, of which 25,000 to 30,000 are under cultivation; so that the great loss to the farmers can easily be imagined, should the crops not come on again. For this, rain is absolutely necessary. The farmers made no move whatever to cope with the plague, and the sub-commission recommends the head commission to be inexorable in imposing fines. The work of extinction is being briskly pushed in other Provinces and is giving good results. Buenos Ayres has not suffered yet, but the plague is coming down apace.

Dr. George F. Becker has sent to the U. S. Geological Survey a report on the mineral resources of the Philippine Islands, in the course of which he says that, so far as is definitely known, the coal of the Philippine Islands is all of the Tertiary age, and might better be characterized as a highly carbonized lignite. It is analogous to the Japanese coal and that of Washington, but not to the Welsh or Pennsylvania coals. Such lignites usually contain much combined water (8 to 18 per cent.) and bear transportation ill. They are also apt to contain much sulphur, as iron pyrites, rendering them subject to spontaneous combustion and injurious to boiler plates. In these islands it would appear that the native coal might supplant English or Australian coal for most purposes. Lignite is widely distributed in the archipelago; some of the seams are of excellent width and the quality of certain of them is high for fuel in this class. Coal exists in various provinces of the Island of Luzon, and a number of concessions for mining have been granted. Many of the other islands contain coal and in the great Island of Mindanao it is known to occurr at eight different localities. In the Island of Cebu petroleum has been found associated with coal at Toledo, on the west coast, where a concession has been granted. It is also reported from Asturias, to the north of Toledo on the same coast, and from Alegria to the south. Natural gas is said to exist in the Cebu coal fields. On Panay, too, oil is reported at Janinay, in the province of Iloilo, and gas is reported from the same island. Petroleum highly charged with paraffin is also found on Leyte at a point about four miles from Villaba, a town on the west coast. Gold is found at a vast number of localities in the archipelago, from northern Luzon to central Mindanao. In most cases the gold is detrital, and is found either in existing water courses or in stream deposits now deserted by the current. Copper ores are reported from a great number of localities in the Philippines. They are said to occur in the following islands: Luzon (provinces of Lepanto, Benguet and Camarines), Mindora, Capul, Masbate, Panay (province of Antique) and Mindanao (province of Surigao). Many of these occurrences are probably unimportant. A lead mine has been partially devel-

oped near the town of Cebu, and there is iron ore in abundance in Luzon, Caraballo, Cebu, Panay and doubtless in other islands. Sulphur deposits abound about active and extinct volcanoes in the Philippines.

UNIVERSITY AND EDUCATIONAL NEWS.

THE fund being collected by the New York Chamber of Commerce as a memorial to the late Colonel Waring, which it is hoped will reach $100,000, three-fourths of this sum having now been given, is to be used, after the death of Mrs. Waring and her daughter, for the endownment of a chair of instruction in municipal affairs in Columbia University.

MR. E. D. MORGAN has given $5,000 for the equipment of a pathological laboratory at the Bussey Institute, Harvard University, of which Professor Theobald Smith is the Director. A new greenhouse, costing $7000, has been given anonymously to the Botanical Garden of the University.

WE regret to note that the will of the late Colonel Bennett, which gave a large endowment to the women's department of the University of Pennsylvania, is being contested.

IT is perhaps not generally known that Cornell University possesses the largest school of naval architecture in America. There are this year fifty students taking naval architecture and marine engineering as their chief subjects.

AT the anniversary dinner of the Royal Society on November 31st Lord Kitchener announced that he had received £40,000 for the foundation of a college at Khartoum. As a further indication of what Great Britain is doing for its imperial subjects we note that plans are being made to establish a Mohammedan University in India.

DR. M. E. WADSWORTH has resigned the Presidency of the Michigan College of Mines. In his letter of resignation he says: "When I came to take charge of this institution it had no hold anywhere and its death was hourly expected. I leave it with you firmly established, a recognized part of the great educational system of the State, a college that ranks with any in the world of its kind, and with many of its graduates leaders in their chosen field. It is now successful, prosperous and of world-wide fame. No mining engineering school in United States ever had such a phenomenal growth in numbers and standing as this one has had in the same space of time, and that, too, under extremely disadvantageous circumstances."

THE *Experiment Station Record* announces the following appointments: At the Idaho College and Station, J. P. Blanton has been appointed President of the University of Idaho and Director of the Station; M. T. French, professor of agriculture in the College and Agriculturist of the Station; Thorn Smith, Assistant Chemist; Professor A. S. Miller, Geologist, and J. A. Huntley has been elected to the newly established chair of horticulture. Elmer D. Ball has been made Assistant Entomologist at the Colorado Station, and A. H. Bryan and R. W. Clothier Assistant Chemists at the Indiana and Kansas Stations, respectively. Charles W. Burkett has been appointed associate professor of agriculture at the New Hampshire College and Station, and James Withycombe Assistant Director and Agriculturist of the Oregon Station. A. W. Blair has been made State Chemist of North Carolina. At the Vermont Station, L. R. Jones and F. A. Waugh have been granted a half year's leave of absence for special studies in botany and horticulture.

THE Council of the University of Paris has authorized courses under the faculty of science by M. Chabrié in applied chemistry, and by M. Favre in methods of experimental science.

THE following appointments and promotions abroad are announced: Dr. Heinrich Obersteiner, assistant professor of physiology and pathology of the central nervous system in the University of Vienna, has been promoted to a full professorship; Dr. Robert Haussner, of Giessen, to an assistant professorship of mathematics, and Dr. K. W. Zimmermann, of Bern, to an associate professorship of anatomy. Dr. Lepetet has been made professor of histology in the University of Clermont, Dr. Oskar Zoth professor of physiology in the University of Gratz, Dr. de Marignac professor of hygiene in the

University of Geneva, and Dr. Hettner, of Tübingen, professor of geography in the University of Würzburg. Professor von Frey, of Leipzig, has received a call to Zurich, and Professor W. C. Röntgen, of Würzburg, a call to Leipzig.

DISCUSSION AND CORRESPONDENCE.

ZOOLOGICAL BIBLIOGRAPHY AND PUBLICATION.

To the Editor of Science: Any criticisms from Dr. W. H. Dall on the Report of the British Association Committee on the above subject are most welcome, and we look forward to receiving his remarks on the several other details to which he implies that exception may be taken. Meanwhile permit me to point out that his criticism of recommendation (not 'rule') 3 is based on several misapprehensions. Dr. Dall speaks for 'the working zoologists,' but, as stated in our Report, those are just the people that an extensive correspondence showed to be in favor of our recommendation. But, whether warranted or unwarranted, our Report neither contains nor rests on any "assumption that the publication of the separate papers of a volume before the volume as a whole is issued is 'improper,' while the indefinite delay of their publication is 'proper.'" On the contrary, the Report makes precisely the same suggestions concerning date as does Dr. Dall (see recommendation 1), and we fully agree as to the advisability of publishing papers promptly and as to the value of separate copies.

Now, what is our recommendation 3? No one would imagine from Dr. Dall's letter that it was this: "That authors' separate copies should not be distributed privately before the paper has been published in the regular manner." The Committee refuses to consider that an author's distribution of a few copies of his paper to a few friends, or to a few workers whose addresses he happens to know, can rank as 'publication.' In the opinion of the Committee, the terms 'public' and 'private' are opposites and not synonyms. The publications of the Philadelphia Academy, the Washington Societies and the U. S. National Museum are not in question. What the Committee had chiefly to consider (as plainly stated in the Report) was the case of smaller publishing bodies, unable, through lack of funds, to follow those admirable examples. Such smaller bodies often allow their contributors to distribute privately a few copies of their individual papers. This private distribution may take place two or three years before the actual publication of the volume or part, and often is confined to the casual presentation of half a dozen copies. Say the paper describes new species of molluscs. How is the worker on molluscs in another country to hear of this paper? How is he to obtain it if he does hear of it? How is he to learn its contents? He cannot be sure that a letter from him will ever reach the author, or that if it does it will meet with any response. Experience teaches otherwise. Meanwhile he himself describes the same species, and his paper is published, is advertised, and is procurable throngh the ordinary channels by anyone that chooses. And so springs up a fresh crop of nomenclature troubles. How can Dr. Dall, as a working zoologist, regard the former method as a greater convenience than the latter?

Our remedy is simply an attempt to regularize this previous distribution, to insist on its being made 'public' as well as 'private.' If separate copies are to be issued before the volume a certain proportion of them must be made accessible to anyone, not merely to friends of the author, and this fact must be publicly announced. In short, we are trying to bring about the very state of things that Dr. Dall admires, and we trust that when he perceives this he will give us his influential support.

Your readers may be interested to know that our Committee has been strengthened by the addition of Mr. B. Daydon Jackson and Mr. A. C. Seward, and now proposes to extend its labors to *botanical* publications. Any criticisms or suggestions on the subjects within the cognizance of the Committee will be gratefully received, and I shall be pleased to send its circulars to those interested. Communications should be addressed to

F. A. Bather,
Secretary of the British Association Committee on Zoological and Botanical Publications.
Natural History Museum,
London, S. W.

MEN OF SCIENCE AND THE HUMANE SOCIETY.

As to the note in SCIENCE (Nov. 25, 1898, p. 743) urging 'Men of Science and Physicians' to write to Senators of the United States in opposition to a bill introduced to Congress by the Humane Society for the restriction of vivisection, we ought to hope that the advice may not be followed, without an investigation of the merits of the case, on the part of the scientific men who have hitherto accepted, without question, the dicta of their medical, physiological and biological friends on the subject. That a great many scientific workers know as little about the charges of 'wanton cruelty,' 'moral degradation,' and unrestricted abuse of experiment alleged by the anti-vivisectionists as the general public there can be no doubt. The necessary knowledge is out of their line of work and observation, and about the only public information on the subject that comes in the way of a busy man is presented in the tracts gratuitously presented and the bulletins and journals published by, for example, the American and Illinois Anti-vivisection Societies, 118 S. 17th St., Philadelphia, and 275 East 42d St., Chicago; the National Anti-vivisection Society of England, 20 Victoria St., London, S. W.; the Humane Education Committee, 61 Westminster St., Providence, R. I.; the Humane Societies and Societies for the Prevention of Cruelty to Animals of Boston, New York (10 East 22d St.), Philadelphia, etc; the Audubon Society of Pennsylvania and various States publishing and dissiminating *Our Fellow Creatures* (Chicago). *Journal of Zoophily* (Philadelphia), *Our Animal Friends* (New York), *The Zoophilist* (London), etc., and abundant tracts and pamphlets. Not unfrequently these materials, under prejudice at the start, stocking the mails together with a mass of modern second- and third-class postal matter, go generally unexamined into the waste-paper basket.

The quoted writer in SCIENCE, however, would assume that the question against the Humane Societies and opponents of painful experiments on living animals was fully settled in the minds of scientific workers in general, and it would appear from the unanimous vote (in the absence of the writer) against the agitation, at a recent meeting of the American Association for the Advancement of Science, that he is right. Yet we believe that not one voter in twenty at the above meeting was qualified to vote, or, if challenged, would have said that he had given the question scientifically just consideration on its merits, either from having studied the nature and rights of animal life or from having investigated the experiments or experimenters as accused by the Humane Societies.

Our colleagues, we might as well admit it, are not exempted by their vocation from the weakness of Adam, and we know that those among them whose minds cannot always be said to be 'open,' too often, by superior activity, 'push,' etc., get the upper hand of meetings where 'resolutions' pass with little or no discussion. However this may have been at the above conference, we stand against the idea of the whole class room turning aside in an alleged important case, fit for their investigating specialty, to follow the advice or unquestioned ipse-dixit of a subdivision of their colleagues.

On the other hand, it seems that it might be commended to us as a phenomenon for wonder and psychic research that any man, by means of gratuitous work, worriment and sleepless nights, in order to limit his own food supply, restrict his range of clothes and adornment and prevent the doctor from curing his own pain, should work for the animals at all. To call the members of the Humane Society fanatics is as easy as to have applied that term to Socrates, Galileo, Wilberforce or Wendell Phillips. But without any prejudice in the matter, we think that the humane agitation, founded on the potent principle of sympathy or love for all living creatures, so omnipotent a factor in the management and development of mankind, will go on. By the truth of the fully heard case, Science will either judge or be judged.

H. C. MERCER.

SECTION OF AMERICAN AND PREHISTORIC ARCHÆOLOGY, UNIVERSITY OF PENNSYLVANIA, November 26, 1898.

[MR. MERCER appears to confuse the work of the Societies for the Prevention of Cruelty to Animals with the antics of the anti-vivisection

people. With the former all men of science are in substantial accord; against the latter argument is almost futile. It has been said that as everyone has a blind spot in his eye so everyone has an idiotic spot in his brain. Anti-vivisection is the idiotic spot of many estimable persons. Regarding the merits of the bill limiting research in the District of Columbia, now pending in the Senate, we cannot do better than refer our readers to a report adopted by the National Academy of Sciences. The report states that physiology must be studied by experimental methods. The physiologist, no less than the physicist and the chemist, can expect the advancement of science only as the result of carefully planned laboratory work. If this work is interfered with, medical science will continue to advance by means of experiment, for no legislation can affect the position of physiology as an experimental science. But there will be this important difference. The experimenters will be medical practitioners and the victims human beings. That animals must suffer and die for the benefit of mankind is a law of nature, from which we cannot escape if we would. But the suffering incidental to biological investigation is trifling in amount and far less than that which is associated with most other uses which man makes of the lower animals for purposes of business or pleasure. The men engaged in the study of physiology are actuated by motives no less humane than those which guide the persons who desire to restrict their actions, while of the value of any given experiment and the amount of suffering which it involves they are, owing to their special training, much better able to judge. When the men to whom the government has entrusted the care of its higher institutions of research shall show themselves incapable of administering them in the interest of science and humanity, then, and not till then, will it be necessary to invoke the authority of the national legislature.—Ed. Science.]

SCIENTIFIC LITERATURE.

Outlines of Sociology. By Lester F. Ward. New York, The Macmillan Company. 1898. Pp. xii+301.

It is never too late to call the attention of competent readers to a work of the value of Dr. Ward's 'Outlines.' Dr. Ward is one of the few authentic scientists to be met with in the variegated crowd of the so-called 'sociologists.' Every contribution of his deserves, therefore, the most careful consideration.

The book contains twelve papers already published in the *American Journal of Sociology*. It is divided into two parts: (I.) Social Philosophy; (II.) Social Science. By the former Dr. Ward means the study of the relations of Sociology to the other sciences. By the latter he means the study of the laws of society. Hereby Dr. Ward has adopted Professor Robert Flint's view, according to which "each special science and even every special subject may be naturally said to have its philosophy, the philosophy of a subject as distinguished from its science being the view or theory of the relations of the subject to other subjects, and to the known world in general, as distinguished from the view or theory of it as isolated or in itself" (p. viii). We believe this distinction to be entirely misleading. Science means investigation of a well defined group of phenomena. Now, the very act of marking or of ascertaining and setting a limit to the field of inquiry presupposes the discussion of the relationship which the group of phenomena under investigation bears to the other groups of phenomena. Thus, on reflecting well, the task assigned to 'philosophy' by Professor Flint appears to be unavoidably coextensive with one of the fundamental exigencies of the scientific research. As long as the discussion of the relationship of the subject to other subjects is carried out merely with the purpose of defining the boundaries of the field of inquiry, we do scientific rather than philosophic work. Philosophy begins only when the study of the relationship which one group of

phenomena bears to another is made subservient to the purpose of reaching a synthetical interpretation of the cosmical phenomena, what the Germans would term 'Weltanschauung.' The highest unification of knowledge embodied in a conception of the universal evolution is, indeed, the specific problem of philosophy. There cannot be, therefore, the 'philosophy' of a detached fragment of reality. We have on the one side the sciences, among which is sociology, and on the other side, philosophy, which includes and supersedes them all.

For these reasons we should like to have the designation of 'Social Philosophy' dropped from the first part of Dr. Ward's book, which, from beginning to end, ought to be considered as a contribution to 'Social Science.' This would practically leave the book unchanged, but would have the inestimable advantage of eliminating any possibility of confusion arising from the misleading notion of 'Social Philosophy.'

But, apart from this unhappy denomination, we find the contents of Part Ist of Dr. Ward's book extremely interesting. He examines in detail the position which Sociology bears to Cosmology, to Biology, to Anthropology, to Psychology and to the special social sciences. The well-known competence of Dr. Ward as a natural scientist gives a particular value to this review of the different groups of phenomena from which social fact is differentiated. In Chapter VI. Dr. Ward discusses the important question of the position which Sociology bears to the special social sciences. Dr. Ward's view is identical to that of Professor Giddings, whose admirable chapter on the 'Province of Sociology,' in his earlier work, has done more than anything else towards the clear demarcation of the place of Sociology among the sciences. According to this theory, Dr. Ward conceives Sociology as the synthesis of the partial results attained through the distinct investigations of the special social sciences. "No one of these (sciences) nor all of them together can be said to form Sociology, but Sociology is the synthesis of them all. It is impossible to perform this synthesis without a clear conception of the elements entering into it. These, therefore, constitute the data for the process. The special social sciences, then, are not themselves the science of Sociology, but they constitute the data of Sociology" (p. 166).

In the second part of his work, Dr. Ward takes up the discussion of the laws of society. He reproduces his well-known conception of the 'psychic' character of the social forces. The most important chapters are the VIIIth: The Mechanics of Society; the Xth: Social Genesis, and the XIth: Individual Telesis, in which the fundamental lines of the theory are set forth with great clearness. The root of Dr. Ward's doctrine is the assumption that 'the social forces are psychic.' "They have their seat in the mental constitution of the individual components of society" (p. 164). Dr. Ward does not mean the thinking faculty only, as it is understood by the popular conception of the mind, but both the *affective* side of the mind and the *perceptive*, and rather the former than the latter. Feeling is the true foundation of social life. It is the 'dynamic agent,' that which impels and that which moves, the *nisus* of nature transferred from the physical to the psychic world (p. 167). It exerts its power through the myriad forms of appetitive desire constituting impulses or impelling forces and motives or moving forces, all of which may be embodied under the general term will (p. 175). Social progress is either genetic or telic. Progress below the human plane is altogether genetic and is called development. In the early human stages it is mainly genetic, but begins to be telic. In the latest stages it is chiefly telic. The transition from genetic to telic progress is wholly due and exactly proportional to the development of the intellectual faculty. The intellectual method is essentially telic. The intellect was developed as an aid to the will for the sole purpose of securing the more complete satisfaction of desire. It enables man to obtain by an indirect method what he could not obtain by a direct method (p. 179). The moment we rise to the social sphere we encounter the telic aspect of the subject. It is still development or evolution, but a new principle, radically different from the genetic, has now been introduced, and in all the higher forms of social progress it assumes the leading rôle (p. 179, 180). It is the faculty of mind which enables man to pursue ends which it

foresees and judges to be advantageous (p. 237). The human intellect is the great source of telic activity (p. 245).

We fully endorse this view of social evolution, which is, in the main lines, in accord with the results of the most recent investigations (Tarde, Baldwin, Giddings, Barth, Stein). But we must call attention to the fact that Dr. Ward's suggestive theory of social telesis cannot acquire a definite meaning if not interpreted in the light of the Imitation-theory. How does invention, *i. e.*, the normal result of telic activity, act upon the social milieu, thus becoming a 'cause' of transformation of the social conditions? In other words, what is the way of propagation of the typical social force, of the dynamic agent, desire, motive, will power? Dr. Ward is silent on this point. Here, evidently, the leading-string is the Imitation-theory, which once more appears to be the corner-stone of sociology.

In conclusion, Dr. Ward's book is a very valuable work, which will undoubtedly contribute to clear the way of the cumbersome remains of the 'biologic' analogies, thus securing the predominance of the psychological interpretation of society, owing to which the shapeless embryo of science, or, rather, the reservoir of 'mauvaise littérature,' known for so long as Sociology, is gradually being changed into a body of knowledge exhibiting some of the characteristic attributes of science.

Gustavo Tosti.

The Instincts and Habits of the Solitary Wasps. By Geo. W. and Elizabeth G. Peckham. Published by the State of Wisconsin. 1898. Pp. 245. Pls. xiv.

It is not too much to say that this work will be regarded as a classic, not only on account of its scientific value, but also as literature. It has all the lucidity and charm that we are accustomed to associate with Gallic genius, while at the same time its exactness in detail would do credit to a German professor. It is a book of incalculable educational value, for it not only exhibits the delights of intelligent nature study, but shows what admirable work may still be done, in any garden in the country, by persons of either sex and almost any age beyond childhood. It does not lay stress on laboratories or apparatus, nor does it demand the outlay of money; those who would follow in the footsteps of our authors have only to exercise those faculties provided them by nature, and, if they have it in them to succeed, success will be theirs.

But let it not be imagined that the work is easy or simple. There is scope for intellectual exercise to the utmost limit, while physical endurance and patience are essential. Think of the mental attitude of some being from Mars who should be placed in a position to observe the doings in a busy city on this earth. How extraordinary, how inexplicable, would some of our most simple and every-day proceedings appear! How wild would be his guesses as to the meaning of this or that! Yet the student of insect psychology is hardly in a more favorable position, and it requires the closest attention and keenest wit to avoid gross errors of judgment. This is well seen in the fact that our present authors have to correct even the accomplished and painstaking Fabre in many of his important conclusions.

Then as to physical endurance; our authors watched their wasps throughout the long hours of the summer days, and sometimes far into the night. When studying *Ammophila* they write: "For a whole week of scorching summer weather we lived in the bean patch, scorning fatigue. We quoted to each other the example of Fabre's daughter Claire, whose determination to solve the problem of *Odynrus* led to a sunstroke. We followed scores of wasps as they hunted; we ran, we threw ourselves upon the ground, we scrambled along on our hands and knees, in desperate endeavors to keep them in view, and yet they escaped us. After we had kept one in sight for an hour or more some sudden flight would carry her far away and all our labor was lost. At last, however, our day came. We were doing a little hunting on our own account, hoping to find some larvæ which we could drop in view of the wasps and thus lead them to display their powers, when we saw an *urnaria* fly up from the ground to the underside of a bean leaf and knock down a small green caterpillar. Breathless with an excitement which will be understood by those who have tasted the joy of such a moment, we hung over the actors in our little

drama. The ground was bare; we were close by and could see every motion distinctly. Nothing more perfect could have been desired." For what followed we can only refer the reader to the book itself, wherein is told even how *Ammophila* used a tool in perfecting her nest.

In the concluding chapter the authors write: "Our study of the activities of wasps has satisfied us that it is impracticable to classify them in any simple way. The old notion that the acts of bees, wasps and ants were all varying forms of instinct is no longer tenable and must give way to a more philosophical view. It would appear to be quite certain that there are not only instinctive acts, but acts of intelligence as well, and a third variety also—acts that are probably due to imitation, although whether much or little intelligence accompanies this imitation is admittedly difficult to determine. Again, acts that are instinctive in one species may be intelligent in another, and we may even assert that there is considerable variation in the amount of intelligence displayed by different individuals of the same species."

The fact of great individual psychological variation is very clearly demonstrated throughout the book; but, since all the observations were made in the same immediate vicinity, it has not been possible to determine whether there exist psychological races among wasps, as among ourselves. It will remain for other observers to repeat the work of the Peckhams in many different localities, and see how far each species is constant over a wide range. There can be little doubt that variations in habits, to suit different environments, are much more common than we know; and it is also evident that psychological and physiological variations, not necessarily accompanied by gross morphological changes, must have a great deal to do with the manner and progress of evolution. Comparative studies in different localities may also explain habits which, studied in one place only, seem useless. Thus the Peckhams cannot explain why *Bembex* is so careful to hide the entrance of her nest, since in the case of the colony studied (on an island) there is apparently no enemy to be guarded against in this manner. It might prove, by studies elsewhere, that this was a device to conceal the nests from nocturnal mice or some other enemy of which we know nothing.

T. D. A. COCKERELL.

MESILLA PARK, N. M., November 10, 1898.

Four-footed Americans and their Kin. By MABEL OSGOOD WRIGHT. Edited by FRANK M. CHAPMAN. With 73 illustrations by ERNEST SETON THOMPSON. New York, The Macmillan Co. 1898. Pp. 432. Price, $1.50.

Among the many popular books on natural history that have appeared recently, very few have treated of mammals and none have been devoted exclusively to them. It is, therefore, gratifying to find in 'Four-footed Americans' an attractive, well-illustrated volume containing accounts of common North American mammals—accounts which, though primarily intended for children, must prove interesting and instructive to older persons.

The book is planned after the manner of 'Citizen Bird,'* by the same author, and is evidently intended as a companion volume. As in 'Citizen Bird,' the descriptions and life histories are presented by interesting characters in the form of stories, which, though not always spiced with adventure, are well calculated to attract young minds and create a wholesome interest in the animals for their own sakes. The spirit of the title is maintained throughout; it is emphatically American—an exceedingly creditable feature. In a household where such a book finds a place children are sure to grow up knowing and loving the animals of their own country.

The book closes with a 'Ladder for climbing the Family Tree of the North American Mammals' (presumably by the editor), which is an abridged and adapted classification, giving a few characters for the larger groups and indicating approximately the number of species of each family. In the few pages devoted to this 'Ladder' errors in typography and nomenclature are not infrequent. Conspicuous among these are the use of *Manatus* instead of *Trichechus*, *Dicotyles* instead of *Tayassu*, *Dorcelaphus* for *Odocoileus* and *Alces alces* for *Alces americanus*. Inaccuracies in the text, also apparently overlooked by the editor, are the statements

* Reviewed in SCIENCE, November 5, 1897, p. 706.

that *Desmodus* (called *Desmodon*) is no larger than our Little Red Bat and that bats do not migrate. The use of the name Least Shrew for *Sorex personatus* seems ill-advised, since there are at least two smaller species and several which do not exceed it in size. Aside from these minor criticisms, there is little but good to be said of the book as a whole. Mr. Thompson's illustrations are numerous and in the majority of cases splendidly executed; that they are well up to his own standard is sufficient commendation.

W. H. Osgood.

A Laboratory Guide in Qualitative Chemical Analysis. By H. L. Wells, M.A., Professor of Analytical Chemistry and Metallurgy in the Sheffield School of Yale University. New York, John Wiley & Sons. Pp. 200. $1.50.

A Short Course in Inorganic Qualitative Analysis for Engineering Students. By J. S. C. Wells, Ph.D., Instructor in Analytical Chemistry, Columbia University. New York, John Wiley & Sons.

Both of these books are new, and both are worthy to be picked out from the innumerable laboratory manuals as much above the average.

Professor H. L. Wells' laboratory guide is the most original and one of the best works on the subject, known to the reviewer.

In a 'notice to the student' in the first chapter of the book, the author says: "The object of this course is to introduce the subject of qualitative analysis in such a way as to develop the powers of observation, inductive reasoning and memory, and at the same time to give a knowledge of chemical facts and methods which will be of use in the future study of this and related subjects." The author's method is to have the student make and preserve a solution of a salt of each of the common bases. The student is then told to test the action of hydrochloric acid on each of these solutions; he finds that three yield a precipitate. Five cc. of each of these three is diluted with two volumes of water and again tested with hydrochloric acid; by further dilution and testing with acid, calculating in each case the amount of salt present, the quantitative limit of the reaction is studied. The student then takes in separate beakers a measured amount of each of the three original solutions, and in a fourth beaker a mixture of the three; all four are precipitated by the acid, filtered, and washed with boiling water. By addition of sulphuric acid to the filtrate from the mixed chlorides a precipitate is formed; by adding sulphuric acid to the filtrate from each of the other chlorides the student finds out which of the three constituents of the mixture caused the precipitation. The action of ammonia on the residues in the filters is then studied, and thus the student works out for himself the common scheme of analysis of the first group.

The other groups are worked out in a similar way; at every step the ingenuity of the author in presenting the problem to the student in the best way is worthy of notice.

The reactions of acids are studied in a similar manner. The book contains no tables, no abbreviated schemes, and everything is done to avoid mechanical work and to lead the student to independent thought. Fresenius' plan of analysis is followed, though various new methods are introduced. Constant references to Fresenius' 'Qualitative Analysis' foster the habit of consulting books of reference.

It is the belief of the reviewer that Professor Wells' method is admirable for students who can devote time enough to the subject, and it is to be hoped that teachers who have classes or single students in this position will give his book a trial.

The book of Dr. J. C. S. Wells, of Columbia, is quite different in character from that of the Yale professor. It is a careful and thorough work, designed for the use of those who can give little time to the subject. It endeavors by exceptionally full and clear descriptive text and tables of scheme reactions to teach qualitative analysis in the least time and with the least labor on the part of the student.

The advantages and disadvantages of the scheme-table system are apparent and have often been discussed. To those teachers who prefer the use of tables Dr. Wells' book can be recommended as one of the best of its kind.

Edward Renouf.

A Text-Book of Mineralogy. With an extended Treatise on Crystallography and Physical

Mineralogy. By EDWARD S. DANA, Professor of Physics and Curator of Mineralogy, Yale University. New York, John Wiley & Sons. New Edition. Cloth. 8vo. Pp. viii +593. Price, $4.00.

The text-book of mineralogy, first issued by Professor E. S. Dana in 1877, has passed through some 17 editions, each a revision of those preceding, the changes hitherto being either corrections or the insertion of supplementary chapters. The edition just issued is essentially a new work, entirely rewritten and considerably enlarged.

The descriptive mineralogy is an abridgement of the sixth edition of the author's System of Mineralogy and needs no comment.

Nearly one-half of the book is devoted to Crystallography and Physical Mineralogy. In crystallography there are especially to be noted the complete replacement of the formerly used Naumann methods of calculation by those of Miller, and the abandonment of the old conception of hemihedrism. The crystals are described under thirty-two symmetry groups, as in Groth, Liebisch and others, and it is perhaps to be regretted that these groups have been renamed for prominent forms, type minerals, or to suggest terms of hemihedrism.

In Physical Mineralogy the optical characters are discussed in considerable detail upon the undulatory theory, no assumption, however, being made as to the elasticity of the ether in crystals, although for convenience the symbols a, b, c, formerly denoting axes of elasticity, are retained as so-called 'ether axes.' Very little space is devoted to apparatus or manipulation. It may be noted also that for the determination of the indices of refraction by total reflection, not only the sections cut normal to the acute bisectrix, as stated, but any section parallel to one of the ether axes a, b or c suffices. It may also be questioned if the stauroscopic methods, p. 221, are in any case either as convenient or more accurate than the microscopic.

Cohesion and Elasticity are concisely discussed, but the space devoted to thermal electrical and magnetic characters, about six pages, is regrettably small.

The work is well printed and illustrated with about 1,000 excellent cuts. An admirable point is the list of selected references at the end of each subject. In every way the work is an improvement upon the last edition.

A. J. M.

SCIENTIFIC JOURNALS.

THE addresses of Professor George E. Hale, on 'The Functions of Large Telescopes' and of Professor Frank P. Whitman on 'Color Vision,' published in the issues of this JOURNAL for May 13th and September 9th respectively, and the paper by Dr. Charles F. Brush on 'A New Gas,' published on October 14th, have been translated into French and printed as leading articles in recent numbers of the *Revue Scientifique*. Professor E. E. Barnard's address on the 'Development of Astronomical Photography' has been translated into German from the issues of this JOURNAL for September 16th and 23d, and published in the *Naturwissenschaftliche Rundschau* for November 26th and December 2d and 9th.

Natural Science will hereafter be published by Mr. Young J. Pentland, 11 Leviot Place, Edinburgh. *Natural Science* has been edited anonymously and this policy will apparently be continued. The current number says: "There will be no change in the policy of the review, no break in continuity, and no lowering of the standard hitherto set before it. But those who wish well to the future of this journal should remember that it lies with them to see that it has a future. Editors cannot edit unless there are contributions of articles, notes and news; publishers cannot publish if every reader reads the copy of a friend or of a library." It may be remarked that publishers and editors are subject to the same conditions in America as in Great Britain.

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES—SECTION OF BIOLOGY—MEETING OF NOVEMBER 14.

THE resignation of Professor E. B. Wilson was read and accepted by the Section. Professor Frederic S. Lee was unanimously elected Chairman of the Section.

The following program was then presented:

1. H. F. Osborn. On the presence of a Frontal Horn in *Aceratherium incisivum* Kaup.
2. H. F. Osborn. On some additional characters of *Diplodocus*.
3. W. D. Matthew. On some new characters of *Clænodon* and *Oxyæna*.
4. W. E. Ritter. On the Ascidians collected by the Columbia University Puget Sound Expedition of 1896. Presented by Dr. Dean.
5. J. P. McMurrich. Report on the Hexactiniæ of the same expedition. Presented by Dr. Calkins.

Professor Osborn described the appearance of an hitherto unrecognized frontal horn on the skulls of *Aceratherium incisivum* Kaup; a discovery of importance, as it practically removes *Aceratherium* from the group to which it gives its name and ranges it with rhinoceroses. Professor Osborn suggested that it may possibly be an ancestor of *Elasmotherium*.

In discussing the paper Dr. Wortman criticised the common tendency to create types based on a single character, citing in support of his suggestion the considerable variations to which single individuals of a species are subject, and giving one or two instances where errors have occurred.

In his second paper Professor Osborn described the structure of the vertebræ of *Diplodocus*, bringing out in considerable detail the variations in the sacrum of the herbivorous Dinosaurs.

Dr. Matthew briefly described the characters of the teeth, manus and pes of *Clænodon*, a form belonging to one of the three families (Arctocyonidæ) which gave rise to the present-day carnivora. The structure of the wrist bones in particular brings this form almost within the limits of the carnivora, and Dr. Matthew regards it as a primitive bear which lived on fruits, honey or other soft foods. *Oxyæna*, another typical Creodont, was also described by Dr. Matthew, the principal points brought out being the disproportion of the brain case, limbs and lower jaw.

In the discussion which followed, Professor Osborn showed that while *Clænodon* undoubtedly possesses many precocious bear-like structures there are many difficulties to push aside before it can be considered the direct ancestor of the bear. There are transitional forms, for example, between dogs and bears, as shown in certain types of teeth (*Amphicyon*), while, on the other hand, there is a marked difference in the size of the brain of the Arctocyonidæ and that of the bears, the brain of the former resembling more closely the brain of the marsupials. If the *Amphicyon* evidence is of a sufficient phylogenetic value the bear line must have arisen much later than Dr. Matthew believes. Dr. Lee also questioned the advisability of ascribing particular functions to specialized structures, a criticism which Dr. Matthew met by saying that in this case the relation of structure to function was in the nature only of an hypothesis, an explanation supplemented by Professor Osborn's statement that in all such cases it is necessary to have some working hypothesis, although each hypothesis is considered merely tentative.

At the request of Dr. Dean, Mr. Richard Weil was asked to give the main results of his observations on the development of the *Ossicula auditus* in the Opossum. Mr. Weil finds that both the malleus and incus are derived from the mandibular arch and have no connection with the hyoidean, thus confirming the older German view.

The other papers on the program presented by Dr. Dean and Dr. Calkins were strictly technical and received only brief mention. They will appear in full in the Annals.

Gary N. Calkins,
Secretary.

The Philosophical Society of Washington.

The 409th meeting of the Society was held at 8 p. m., November 26th, at the Cosmos Club. The first paper of the evening was by E. D. Preston on the International Geodetic Association Conference at Stuttgart from October 3d to October 12th. The 2d was by Dr. Cyrus Adler on an International Catalogue of Scientific Literature. The 3d was by Mr. René de Saussure on the Graphical Determination of Stream Lines. A diagram showing an application of the last paper will be presented at the next meeting.

E. D. Preston,
Secretary.